Nuclear Science Abstracts

Vol. 7 No. 5A

Abstracts 1571 to 1856

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ERRATA

Vol. 5, p.591. In abstract 3722, H. T. Giovanni should be changed to H. J. Giovanni.

Vol. 5, p.1053. In abstract 7219, Massachusetts Inst. of Tech. should be changed to Solid State and Molecular Theory Group, Mass. Inst. of Tech.

Vol. 6, No. 1. In abstract 202, p.27 and in Reports Reference List, p.vi, report COO-83, Stephen P. Mitoff should be changed to Stephan P. Mitoff.

Vol. 6, No. 3. In abstract 916, p.115 and in Reports Reference List, p.vi, report COO-86, L. Thomasen should be changed to L. Thomassen.

Vol. 6, No. 6A. In abstract 1617, p.207 and in Reports Reference List, p.vi, report UCLA-181, California Univ., School of Medicine should be changed to Atomic Energy Project, Univ. of Calif., Los Angeles.

Vol. 6, No. 7. In abstract 2166, p.273 and in Reports Reference List, p.v, report NP-3594, Massachusetts Inst. of Tech. should be changed to Solid State and Molecular Theory Group, Mass. Inst. of Tech.

Vol. 6, No. 9. In abstract 2558, p.325 and in Reports List, p.viii, report NP-3642, Air Univ. School of Radiation Medicine should be changed to Air Force Radiation Lab., Univ. of Chicago.

Vol. 6, No. 9. In abstract 2568, p.327 and in Reports Reference List, p.viii, report NP-3690, Air Univ. School of Medicine should be changed to Northwestern Univ. Medical School.

Vol. 6, No. 15. In abstract 4343, p.531 and in Reports Reference List, p.vi, report UCLA-204, California Univ., School of Medicine should be changed to Atomic Energy Project, Univ. of Calif., Los Angeles.

Vol. 6, No. 23. In abstract 6549, p.798 and in Reports Reference List, p.iv, report ISC-272, Institute of Atomic Research, Iowa State Coll. should be changed to Ames Lab.

Vol. 7, No. 1. In abstract 419, p.51, and in Reports Reference List, p.iv, report ISC-282, Institute of Atomic Research, Iowa State Coll. should be changed to Ames Lab. Correct Author Index in the same issue.

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EFFECT OF SHAPE AND MATERIAL ON THE THERMAL RUPTURE OF CERAMICS, by E. M. Baroody, W. H. Duckworth, E. M. Simone, and H. Z. Schofield. May 22, 1951. Decl. Jan. 21, 1953. 75p. (AECD-3486; BMI-70)

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SAMPLES OF SOIL FROM ARCO, IDAHO (Information Report). by G. D. Stewart. Nov. 22, 1949. Decl. Jan. 27, 1953. 7p. (AECD-3487; MLM-401)

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THE ELECTRICAL CONDUCTIVITY OF URANYL SULFATE AND URANYL FLUORIDE IN AQUEOUS SOLUTION, by Robert D. Brown, W. B. Bunger, W. L. Marshall, and C. H. Secoy. [Dec. 1952]. Decl. Dec. 19, 1952. 30p. (AECD-3488; CF-52-12-56(rev.))

AECD-3489 1611
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NEUTRON ACTIVATION ANALYSIS: A USEFUL ANALYTICAL METHOD FOR DETERMINATION OF TRACE ELEMENTS, by G. W. Leddicotte and S. A. Reynolds. Issued Jan. 2, 1953. Decl. Jan. 27, 1953. 30p. (AECD-3489; ORNL-1443)

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AECU-2331 1689
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PROGRESS REPORT NO. II [ON] RESEARCH IN NUCLEAR PHYSICS. June 15, 1952. 35p. (AECU-2331)

AECU-2339 1690
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MEMBRANE AND BENDING ANALYSIS OF AXISYMMETRICALLY LOADED AXISYMMETRICAL SHELLS, by G. Horvay, and I. M. Clausen. [nd] 18p. (AECU-2343)

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TWENTY-SEVENTH PROGRESS REPORT [FOR] PERIOD AUGUST 31, 1952 TO NOVEMBER 30, 1952. Nov. 30, 1952. 59p. (AECU-2347)

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THE INFLUENCE OF TEMPERATURE AND ILLUMINATION ON THE EXCHANGE OF POTASSIUM ION IN ULVA LACTUCA, by George T. Scott and Hugh R. Hayward. Oberlin Coll. and Marine Biological Lab., Woods Hole. [nd] 9p. (AECU-2357)

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TECHNICAL REPORT NO. VIII [ON] A THEORY OF CATION EXCHANGE REACTIONS WITH CLAY MINERALS, by Ivan B. Cutler and Melvin A. Cook. May 1, 1952. 28p. (AECU-2382; Tech. Report No. 8)

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AN IMPROVED AC ELECTROMAGNETIC PUMP CELL, by M. E. LaVerne. Dec. 7, 1952. 15p. (CF-52-12-153)

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KAPL-844 1856
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THE REFINED CRYSTAL STRUCTURE OF BETA-URANIUM by C. W. Tucker, Jr. and P. Senio. Nov. 3, 1952. 36p. (KAPL-844)

KLI-1425 1737
Carbide and Carbon Chemicals Co. (K-25)
THICKNESS MEASUREMENTS OF THIN FILMS BY MULTIPLE-BEAM INTERFEROMETRY, by T. W. Bartlett and Frances L. Ball. May 13, 1952. 12p. (KLI-1425)

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QUARTERLY PROGRESS REPORT [FOR] OCTOBER–DECEMBER, 1952; DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT; JOB 24-A. Jan. 20, 1953. 11p. (KLX-1383)

LA-1400 1583
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THE BIOLOGICAL EFFECTIVENESS OF THERMAL NEUTRONS IN INHIBITING MITOSIS IN MICE, by John Storer. Nov. 1952. 25p. (LA-1400)

LA-1479 1791
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ABSOLUTE CROSS SECTION FOR THE REACTION $T(d,n)He^4$ FROM 10 TO 120 KEV, by W. R. Arnold, J. A. Phillips, G. A. Sawyer, E. J. Stovall, Jr., and J. L. Tuck. Oct. 1952. 38p. (LA-1479)

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THE CROSS SECTION FOR THE $He^3(d,p)He^4$ REACTION FROM 35-100 KEV, by W. R. Arnold, J. A. Phillips, G. A. Sawyer, E. J. Stovall, Jr., and J. L. Tuck. Oct. 1952. 8p. (LA-1481)

LA-1486 1719
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A 100 WATT RADIO-FREQUENCY INDUCTION HEATER, by George N. Rupert. Dec. 1952. 14p. (LA-1486)

LA-1488 1609
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MATHEMATICAL STUDIES ON GALVANIC CORROSION. PART I. COPLANAR ELECTRODES WITH NEGLIGIBLE POLARIZATION, by J. T. Waber. Nov. 17, 1952. 29p. (LA-1488)

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Rensselaer Polytechnic Inst.
PROGRESS REPORT [FOR OCTOBER 1, 1951 TO SEPTEMBER 30, 1952,] by G. N. Glasoe, H. Landon, and W. A. McKinley. Oct. 1952. 48p. (NYO-869)

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STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS, by J. L. Hoard. Jan. 2, 1953. 7p. (NYO-931)

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NYO-3311 1630
Yale Univ.
PROGRESS REPORT NO. 4 [ON] EFFECT OF GAMMA RADIATION ON HYDROCARBON GASES [FOR] THIRD QUARTER, 1952. Oct. 30, 1952. 14p. (NYO-3311; Progress Report No. 4)

NYO-3707 1722
Rochester Univ.
A STABLE AND LINEAR AMPLIFIER FOR THE MEASUREMENT OF SMALL DIRECT CURRENTS, by H. W. Fulbright. Oct. 17, 1952. 5p. (NYO-3707)

NYO-3811 1648
Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 14, SCOPE II, by B. L. Averbach, M. Cohen, P. S. Rudman, E. E. Underwood, W. F. Flanagan, and J. Hilliard. Dec. 31, 1952. 3p. (NYO-3811; Tech. Progress Report 14)

NYO-3812 1685
Massachusetts Inst. of Tech.
FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION; TECHNICAL PROGRESS REPORT NO. 9, SCOPE III, by B. L. Averbach, M. Cohen, S. Allen, and P. Fopiano. Dec. 31, 1952. 3p. (NYO-3812; Tech. Progress Report 9)

ORNL-1342 1695
Oak Ridge National Lab.
ENTHALPIES AND HEAT CAPACITIES OF STAINLESS STEEL (316), ZIRCONIUM, AND LITHIUM AT ELEVATED TEMPERATURES, by R. F. Redmond and J. Lones. Issued Dec. 30, 1952. 24p. (ORNL-1342)

ORNL-1399 1649
Oak Ridge National Lab.
A STUDY OF THE ELECTRODEPOSITION OF RUTHENIUM FROM VERY DILUTE SOLUTIONS, by M. H. Lietzke and J. C. Griess, Jr. Issued Feb. 2, 1953. 30p. (ORNL-1399)

ORNL-1464 1731
Oak Ridge National Lab.
NUMERICAL ANALYSIS OF BETA SPECTRA: I. NON-UNIQUE FORBIDDEN SPECTRA, by M. E. Rose. Issued Feb. 2, 1953. 7p. (ORNL-1464)

ORO-85 1602
Louisiana State Univ.
DETECTION OF MICROBIAL TOXINS BY THE USE OF RADIOISOTOPES, by H. E. Wheeler. [nd] 12p. (ORO-85)

ORO-86 1686
Tennessee Univ.
CALORIMETRIC STUDIES OF PLASTIC DEFORMATION AND PHASE TRANSFORMATIONS FOR PERIOD ENDING DECEMBER 1, 1952, by E. E. Stansbury, G. E. Elder, and M. L. Picklesimer. [nd] 6p. (ORO-86)

SO-2025 1687
General Electric Research Lab.
THERMODYNAMICS OF ORDERING ALLOYS: I. ACTIVITIES IN COBALT-PLATINUM ALLOYS, AND SOME GENERAL CONSIDERATIONS ON ORDERING SYSTEMS, by R. A. Oriani. Dec. 1952. 24p. (SO-2025; RL-777)

UCLA-239 1578
Atomic Energy Project, Univ. of Calif., Los Angeles
THE COMPUTATION OF CARDIAC OUTPUT FROM DYE DILUTION CURVES, by Alvin E. Lewis. Issued Jan. 13, 1953. 9p. (UCLA-239)

UCRL-1863 1631
Radiation Lab., Univ. of Calif., Berkeley
HIGH ENERGY HELIUM-ION IRRADIATION OF AQUEOUS ACETIC ACID SOLUTIONS, by Warren M. Garrison, Herman R. Haymond, Donald C. Morrison, Boyd M. Weeks, and Jeanne Gile-Melchert. Dec. 1, 1952. 30p. (UCRL-1863)

UCRL-2001 1597
Radiation Lab., Univ. of Calif., Berkeley
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT FOR JULY, AUGUST, AND SEPTEMBER, 1952. Nov. 10, 1952. 134p. (UCRL-2001)

UCRL-2001(p.3-83) 1598
Radiation Lab., Univ. of Calif., Berkeley
THE PHYSIOLOGY AND TREATMENT OF POLYCYTHEMIA VERA, p.3-83 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT FOR JULY, AUGUST, AND SEPTEMBER, 1952. Nov. 10, 1952. 81p. (UCRL-2001(p.3-83))

UCRL-2001(p.84-104) 1585
Radiation Lab., Univ. of Calif., Berkeley
THE METABOLIC PROPERTIES OF VARIOUS MATERIALS AND THE PATHOLOGICAL EFFECTS OF ASTATINE, p.84-104 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT FOR JULY, AUGUST, AND SEPTEMBER, 1952. Nov. 10, 1952. 21p. (UCRL-2001(p.84-104))

UCRL-2019 1834
Radiation Lab., Univ. of Calif., Berkeley
THE ALPHA BRANCHING OF AcK AND THE PRESENCE OF ASTATINE IN NATURE, by Earl K. Hyde and Albert Ghiorso. Nov. 19, 1952. 17p. (UCRL-2019)

UCRL-2026 1656
Radiation Lab., Univ. of Calif., Berkeley
NOTES ON THE PREPARATION OF HYDROGEN CYANIDE-C^{14} FROM $BaC^{14}O_3$. II., by R. M. Lemmon. Nov. 21, 1952. 4p. (UCRL-2026)

UCRL-2031 1816
Radiation Lab., Univ. of Calif., Berkeley
STATISTICAL FLUCTUATIONS IN IONIZATION BY 31.5 MEV PROTONS, by G. J. Igo, D. D. Clark, and R. M. Eisberg. Nov. 24, 1952. [nd] 6p. (UCRL-2031)

UCRL-2055 1809
Radiation Lab., Univ. of Calif., Berkeley
SUMMARY OF RESEARCH PROGRESS MEETING OF SEPTEMBER 18, 1952, by Sergey Shewchuck. Dec. 16, 1952. 9p. (UCRL-2055)

UCRL-2059 1696
Radiation Lab., Univ. of Calif., Berkeley
SUMMARY OF RESEARCH PROGRESS MEETINGS OF OCTOBER 16, 23, AND 30, 1952, by Sergey Shewchuck. Dec. 18, 1952. 3p. (UCRL-2059)

UCRL-2060 1835
Radiation Lab., Univ. of Calif., Berkeley
STUDIES OF NEUTRON-DEFICIENT ISOTOPES OF EMANATION, FRANCIUM, AND RADIUM (thesis), by F. F. Momyer. Feb. 1953. 70p. (UCRL-2060)

UCRL-2062 1736
Radiation Lab., Univ. of Calif., Berkeley
LARGE ANGLE SCATTERING OF NEGATIVE PIONS IN ALUMINUM, COPPER, AND LEAD (thesis), by H. H. Heckman. Dec. 23, 1952. 51p. (UCRL-2062)

UCRL-2079 1839
Radiation Lab., Univ. of Calif., Berkeley
STUDIES OF NEUTRON DEFICIENT TERBIUM NUCLIDES, by M. A. Rollier and J. O. Rasmussen. Jan. 9, 1953. 8p. (UCRL-2079)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE-G/R-1010 1735
Atomic Energy Research Establishment, Harwell, Berks (England)
A 9" EXPANSION CLOUD CHAMBER, by H. S. Tomlinson, E. W. Titterton, and G. F. Snelling. Oct. 3, 1952. 13p. (AERE-G/R-1010)

AF-TR-6686 1680
Armour Research Foundation
STRUCTURAL CHANGES OF COMMERCIAL TITANIUM AND TITANIUM-BASE ALLOYS ON HEAT TREATMENT, by William Rostoker and Max Hansen. Nov. 1951. 59p. (AF-TR-6686; ATI-159575)

CEA-26 1614
Commissarist à l'Énergie Atomique (France)
DOSAGE COLORIMETRIQUE DE L'ION FLUOR — APPLICATION À L'URANIUM METAL ET AU FLUORURE URANEUX. (COLORIMETRIC DETERMINATION OF THE FLUORIDE ION — APPLICATION TO URANIUM METAL AND TO URANOUS FLUORIDE), by H. Hering, J. Hure, and S. Legrand. Dec. 1949. 20p. (CEA-26)

CEA-30 1672
Commissariat à l'Énergie Atomique (France)
UNE NOUVELLE ESPECE URANIFÈRE FRANÇAISE: LA RENARDITE. (A NEW FRENCH URANIFEROUS SPECIES: RENARDITE), by G. Branche, J. Chervet, and C. Guillemin. Dec. 1949. 7p. (CEA-30)

CEA-34 1673
Commissariat à l'Énergie Atomique (France)
UNE NOUVELLE ESPÈCE URANIFERE FRANÇAISE: LA PARSONSITE. (A NEW FRENCH URANIFEROUS SPECIES: PARSONSITE), by G. Branche, J. Chervet, and C. Guillemin. Dec. 1949. 13p. (CEA-34)

CEA-47 1693
Commissariat à l'Énergie Atomique (France)
L'ABAISSEMENT DES CHAMPS ENTRE CYLINDRES COAXIAUX AU MOYEN D'ÉCRANS INTERCALÉS. (REDUCTION OF FIELDS BETWEEN CO-AXIAL CYLINDERS BY MEANS OF INTERPOSED SCREENS), by J. Bernard, H. Bruck, and F. Prevot. May 1950. 18p. (CEA-47)

NACA-TN-2426 1659
California Univ., Berkeley
AN INVESTIGATION OF AIRCRAFT HEATERS. XXXIV. EXPERIMENTAL DETERMINATION OF THERMAL AND HYDRODYNAMICAL BEHAVIOR OF AIR FLOWING BETWEEN A FLAT AND A WAVE-SHAPED PLATE, by L. M. K. Boelter, V. D. Sanders, G. Young, M. Morgan, and E. H. Morrin. Aug. 1951. 30p. (NACA-TN-2426)

NACA-TN-2865 1667
National Bureau of Standards
INVESTIGATION OF GASES EVOLVED DURING FIRING OF VITREOUS COATINGS ON STEEL, by Dwight G. Moore and Mary A. Mason. Jan. 1953. 34p. (NACA-TN-2865)

NM-008-012.04.02 1584
Naval Medical Research Inst., Bethesda
EFFECTS OF TOTAL BODY X-RADIATION ON SALIVARY COMPONENTS OF DOGS, by J. L. Nemes, M. G. Wheatcroft, and R. S. Leopold. Naval Medical Research Inst., Bethesda and Maryland Univ. July 29, 1952. 9p. (NM-008-012.04.02)

NM-000-018.07.20 1728
Naval Medical Research Inst., Bethesda
A MASS-SPECTROMETER-TUBE-UNIT PREALIGNING AND POSITIONING JIG FOR THE CONSOLIDATED 21-102 SPECTROMETER, by Louis P. Cecchini and James George. Aug. 1, 1952. 12p. (NM-000-018.07.20; Memo Report 52-8)

NP-4215 1610
Illinois Inst. of Tech.
STUDIES OF FAST REACTIONS WHICH EVOLVE GASES. THE REACTION OF SODIUM-POTASSIUM ALLOY WITH WATER IN THE PRESENCE AND ABSENCE OF OXYGEN, by Martin Kilpatrick, Louis L. Baker, Jr., and C. Dana McKinney, Jr. Oct. 1952. 27p. (NP-4215; Technical Report No. 6; U-25213)

NP-4251 1842
Norman Bridge Lab. of Physics, Calif. Inst. of Tech.
NINETEENTH QUARTERLY REPORT [ON] FUNDAMENTAL RESEARCH IN SPECTROSCOPY OF SHORT WAVE-LENGTH X-RAYS AND GAMMA-RAYS [FOR] PERIOD – OCT. 1 – DEC. 31, 1951, by Jesse W. M. DuMond. [nd] 22p. (NP-4251; Quarterly Report No. 19)

NP-4254 1681
Carnegie Inst. of Tech.
FINAL REPORT [ON] RESEARCH AND DEVELOPMENT OF EFFECT OF RANGE OF STRESS AND PRESTRAIN ON THE FATIGUE PROPERTIES OF TITANIUM AND ITS ALLOYS, by J. P. Romualdi and E. D'Appolonia. Oct. 1952. 82p. (NP-4254; WAL-401/68-15)

NP-4256 1682
Carnegie Inst. of Tech.
INTERIM TECHNICAL REPORT NO. 2 ON GALLING AND SEIZING CHARACTERISTICS OF TITANIUM AND TITANIUM-BASE ALLOYS [FOR] APRIL 15, 1952 – OCTOBER 15, 1952, by William C. Leone. [nd] 22p. (NP-4256; Interim Technical Report No. 2; WAL-401/65-13)

NP-4260 1683
Battelle Memorial Inst.
SECOND INTERIM TECHNICAL REPORT ON CHEMICAL SURFACE TREATMENT OF TITANIUM [FOR FEBRUARY 1, 1952 TO OCTOBER 31, 1952] TO WATERTOWN ARSENAL, by H. A. Pray, Paul D. Miller, Richard A. Jefferys, and R. L. Gibbs. Oct. 31, 1952. 52p. (NP-4260; WAL-401/45-18; Interim Technical Report No. 2)

NP-4264 1738
Chemical and Physical Labs., Federal Telecommunication Labs., Inc.
NATIONAL DEFENSE CONTRACTUAL PROGRESS REPORT NO. 6 [ON] IONIZATION CHAMBER INSULATING MATERIAL; SECOND QUARTERLY REPORT [FOR] OCTOBER 15, 1951 – JANUARY 15, 1952, by H. G. Nordlin, D. K. Keel, C. H. Mayhew, and S. Kaganoff. Jan. 1952. 53p. (NP-4264; National Defense Contractual Progress Report No. 6; U-20861)

NP-4265 1739
Chemical and Physical Labs., Federal Telecommunication Labs., Inc.
NATIONAL DEFENSE CONTRACTUAL PROGRESS REPORT NO. 3 [ON] IONIZATION CHAMBER INSULATING MATERIAL; FIRST QUARTERLY REPORT [FOR] JULY 15 – OCTOBER 15, 1951, by H. G. Nordlin, D. K. Keel, C. H. Mayhew, and S. Kaganoff. Oct. 1951. 53p. (NP-4265; ATI-121284; National Defense Contractual Progress Report No. 3; U-20108)

NP-4266 1740
Chemical and Physical Labs., Federal Telecommunication Labs., Inc.
NATIONAL DEFENSE CONTRACTUAL PROGRESS REPORT NO. 9 [ON] IONIZATION CHAMBER INSULATING MATERIAL; THIRD QUARTERLY REPORT [FOR] JANUARY 15 – APRIL 15, 1952, by H. G. Nordlin and D. K. Keel. Apr. 1952. 28p. (NP-4266; National Defense Contractual Progress Report No. 9; U-22031)

NP-4267 1652
Mallinckrodt Chemical Lab., Harvard Univ.
THE MICROWAVE SPECTRUM AND STRUCTURE OF CHLOROFLUOROMETHANE, by Norbert Muller. [nd] 18p. (NP-4267)

NP-4268 1843
Mallinckrodt Chemical Lab., Harvard Univ.
A (K+2)ND ORDER FORMULA FOR ASYMMETRY DOUB DOUBLETS IN ROTATIONAL SPECTRA, by Daniel Kivelson. [nd] 10p. (NP-4268)

NP-4329 1721
Wollensak Optical Co.
[PAPERS PRESENTED AT THE INTERNATIONAL SYMPOSIUM ON HIGH-SPEED PHOTOGRAPHY, by John H. Waddell.] Aug. 26, 1952. 41p. (NP-4329)

NP-4341 1615
Department of Mines and Technical Surveys, Mines Branch, Ottawa (Canada)
THE AMPEROMETRIC DETERMINATION OF SULPHATE, by A. Hitchen. Dec. 17, 1952. 11p. (NP-4341; TR-106/52)

NP-4343 1741
[Applied Research Labs., Glendale, Calif.]
FIRST QUARTERLY REPORT [ON] RESEARCH INVESTIGATIONS DIRECTED TOWARD ESTABLISHMENT OF METHODS FOR QUANTITATIVE SPECTROGRAPHIC ANALYSES OF RAW AND PROCESSED MATERIALS [FOR] NOVEMBER 15, 1951 TO JANUARY 15, 1952, by M. F. Hasler and J. W. Kemp. 15p. (NP-4343)

NP-4347 1668
Fansteel Metallurgical Corp.
INTERIM REPORT [ON] STUDY AND RESEARCH OF THE SILICONIZING OF TITANIUM FOR PERIOD JULY 1, 1952 THROUGH DECEMBER 31, 1952, by Stanley Kluz, Caesar Kalinowski, and Ralph Wehrmann. [Jan. 26, 1953.] 27p. (NP-4347; 401/51-18)

NP-4348 1660
Massachusetts Inst. of Tech.
VISUAL STUDY OF WATER FLOWING OVER A FLAT PLATE AT HIGH RATES OF HEAT TRANSFER WITH SURFACE BOILING, by Robert W. Jeffery. Nov. 1, 1952. 64p. (NP-4348)

NP-4353 1700
Washington State Coll.
[PROGRESS REPORT ON] HIGH ENERGY COSMIC RAY SHOWERS UNDER THICK ABSORBERS [FOR] SEPTEMBER 1 TO DECEMBER 1, 1952, by T. G. Stinchcomb. Dec. 1, 1952. 5p. (NP-4353; Report No. 1)

SUI-53-1 1701
Iowa State Univ.
THE COSMIC RAY INTENSITY ABOVE THE ATMOSPHERE NEAR THE GEOMAGNETIC POLE, by James A. Van Allen. Jan. 1953. 42p. (SUI-53-1)

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 March 31, 1953 No. 6A

GENERAL

RESEARCH PROGRAMS

1571

THE EUROPEAN NUCLEAR PHYSICS LABORATORY. J. de Boer. Nederland. Tijdschr. Natuurk. 18, 285-91(1952) Dec. (In Dutch)

Organization, finances, and plans of the European Council for Nuclear Research are discussed. Construction of a 600-Mev synchrocyclotron and a 10-bev, or possibly a 30-bev, proton synchrotron is contemplated. (G.Y.)

BIOLOGY AND MEDICINE

1572

Pittsburgh Univ. School of Medicine

THE PRESENCE OF COMPLEMENT IN NORMAL RABBIT SERUM. II. EFFECT ON ANTIGEN AND ANTIBODY PRECIPITATION, by Paul H. Maurer and David W. Talmage. [nd] 12p. (AECU-2352)

The effect of the presence of complement in normal rabbit sera on both the antigen and antibody precipitation behavior in the region of antigen excess has been shown. It has been postulated that complement causes some of the soluble antigen–antibody complexes to become insoluble, thus, shifting the equilibria existing in the region of antigen excess. Only 60 per cent of the complement nitrogen was removed by 100 μg N of an Ea-anti Ea specific precipitate per ml of serum. The precipitin curves obtained in the presence of 0.85% saline and 5% serum albumin are similar. The degree of iodination of gamma globulin molecules and antibody molecules (anti BSA) is fairly similar. (See AECU-2085 for Part I) (auth)

1573

Biological Lab., Cold Spring Harbor

AN ANALYSIS OF VARIABILITY ARISING THROUGH RECOMBINATION, by Bruce Wallace, J. C. King, Carol V. Madden, Bobbie Kaufmann, and E. C. McGunnigle. [nd] 75p. (AECU-2362)

Experimental results from genetic studies using Drosophila are presented which support the hypothesis that selection acts to build up genetic heterogeneity. (C.R.)

1574

Institute of Radiobiology and Biophysics, Univ. of Chicago

THE OCCURRENCE OF GENERALIZED INFECTION OF ENTERIC ORIGIN IN MICE POISONED WITH NITROGEN MUSTARD, by Carolyn W. Hammond, Marianne Tompkins, and C. Phillip Miller. [nd] 12p. (AECU-2363)

Generalized infection of enteric origin seems to play a less important role as a cause of death in mice poisoned with nitrogen mustard than in mice subjected to moderate doses of total-body x radiation. (auth)

1575

Oberlin Coll.

THE INFLUENCE OF IODOACETATE ON THE SODIUM AND POTASSIUM CONTENT OF ULVA LACTUCA AND THE PREVENTION OF ITS INFLUENCE BY LIGHT, by George T. Scott and Hugh R. Hayward. Oberlin Coll. and Marine Biological Lab., Woods Hole. [nd] 9p. (AECU-2370)

A study of the influence of the glycolytic inhibitor, monoiodoacetate, on the Na and K content in green algae in the dark and in the light showed a marked loss of K ions from the cells in the dark and the inhibitor to be completely ineffective in causing the loss of K ions in the presence of light, while cellular Na was increased in the dark and reduced in the presence of light, again indicating inaction of the inhibitor in the presence of light. The hypothesis of an active Na extrusion process dependent on glycolytic energy is discussed. (C.R.)

1576

Pennsylvania Univ. School of Medicine

PRELIMINARY STUDIES INTO THE CONDITIONS CONTROLLING CELLULAR FUSION AND SECONDARY COLONY FORMATION IN BACILLUS MEGATERIUM, by Edward D. DeLamater and Mary Elizabeth Hunter. Jan. 8, 1953. 13p. (AECU-2371)

The effects of biological, physical, and chemical factors on conjugation and secondary colony formation by Bacillus megaterium have been presented and discussed. Conjugation occurred most readily on human blood agar, 5 to 6 hours after inoculation with a spore suspension. Protein or amino acids appeared to be necessary to the formation of both conjugation tubes in detectable numbers and secondary colonies. (auth)

1577

Kansas Univ. School of Medicine

CHEMICAL AND ENZYMATIC CHANGES IN LIVER FOLLOWING FREEZING-DRYING AND ACETONE FIXATION, by M. Berenbom, H. O. Yokoyama, and R. E. Stowell. [nd] 14p. (AECU-2387)

The chemical composition and enzymatic activity of mouse liver following procedures used in the preparation of tissues for histochemical studies show that high percentages of enzyme activity and chemical constituents are retained after freezing alone and freezing-drying. Negligible additional losses occurred in frozen-dried tissues as a result of a short heating period and treatment with xylol. Considerable loss of material and substantial reduction in the activity of acid and alkaline phosphatase and esterase occur after paraffin embedding, deparaffinization and hydration. Under the same conditions the activity of succinoxidase and cytochrome cooxidase is completely destroyed. In acetone fixation, in contrast to freezing-drying, there is a greater initial loss of enzyme activity and soluble substances, with further loss upon deparaffinization and hydration. (auth)

1578

Atomic Energy Project, Univ. of Calif., Los Angeles

THE COMPUTATION OF CARDIAC OUTPUT FROM DYE DILUTION CURVES, by Alvin E. Lewis. Issued Jan. 13, 1953. 9p. (UCLA-239)

This method for computing cardiac output from dye-dilution data is faster, more accurate, and less tedious than the customary graphic methods. Summation of successive points or sample concentrations replaces graphic area measurements; the appearance of a constant quotient between sample concentrations is used to replace the final linear slope obtained with semi-log plots of the data. (auth)

RADIATION EFFECTS

1579

Argonne National Lab.

THE EFFECT OF X-RAYS ON THE UPTAKE AND LOSS OF IONS BY POTATO TUBER TISSUE, by Robert B. Withrow, Edward S. Mika, and Noe Higinbotham. Dec. 1952. 14p. (AECU-2368; UAC-683)

The effect of x rays on relative rates of ion uptake, loss, and movement in a mature plant parenchyma tissue was studied, with particular emphasis on immediate physiologic response. X irradiation was found to depress the rate of accumulation of Rb^{86} by excised disks of potato tuber tissue, to increase the rate of loss of ions from excised disks in distilled water, and to decrease conductivity in intact tubers. The theory of a transfer mechanism, which would probably be damaged by x irradiation, is discussed. (C.R.)

1580

Argonne National Lab.

GAMMA-NEUTRON RADIATION CHAMBER FOR RADIOBIOLOGICAL STUDIES, by Howard H. Vogel, Jr., Roland A. Blomgren, and Wils J. G. Bohlin. Nov. 1952. 33p. (AECU-2369; UAC-668)

An animal exposure chamber is described which was designed for use in studies of the radiobiological effects of γ or of fast neutron radiation or a mixture of the two in varying proportions. The thermal column of a reactor, in conjunction with a sheet of U to convert the thermal flux to one of fission neutrons, is used as the fast neutron source. Gamma rays from this source are absorbed by shielding, and fast neutrons contaminated by less than 10% γ radiation, are produced. A pure γ source is provided by 18 Co^{60} sources housed in a special turret built into the radiation exposure chamber at the end opposite from the neutron source. For dosimetry measurements, probe holes were made in the cage, a special probe drive was designed for remote positioning of probes, and a rate meter was installed that can be read directly in r/min. A trailer is used to move the 12-ton chamber and to position it against the pile. A schematic sketch and 14 photographs show details of construction. A motion picture has been prepared to illustrate the operations of the radiation chamber. The chamber is now being used to test the problem of additivity of these two forms of ionizing radiation on lethality of mice. (C.R.)

1581

Argonne National Lab.

THE EFFECTS OF TOTAL-BODY X IRRADIATION ON THE TISSUE MAST CELL, by Douglas E. Smith and Yevette S. Lewis. Dec. 1952. 10p. (AECU-2377; UAC-674)

The effect of total-body x irradiation upon the state of the tissue mast cells in the cheek pouch and/or mesentery in the hamster and the mouse was studied. Following exposure there occurred in the tissue mast cells a series of striking changes the end result of which appeared to be disruption of the cell with dispersion of its contents into the surrounding tissues. The possible relationships of these findings to the hemorrhage and clotting defect of the radiation syndrome was discussed. (auth)

1582

Argonne National Lab.

THE INFLUENCE OF TEMPERATURE UPON THE ACTIVATION OF A BACTERIAL VIRUS BY X-RAYS, by C. S. Bachofer, C. F. Ehret, S. D. Mayer, and E. L. Powers. Argonne National Lab. and Notre Dame Univ. Nov. 1952. 15p. (AECU-2381; UAC-669)

The effects of widely separated temperatures during x irradiation on survival of dried samples of T-1 bacteriophate of E. coli was investigated. Data are presented for the relation between survival of bacteriophage and relative dosage of x rays at temperatures ranging from 77 to 310°K, the relation between the dose-inactivation constant and temperature, and the relation between the estimated temperature-dependent component of the dose-inactivation constant and the reciprocal of the temperature. The possibility of the inactivation constant being composed of two components, one temperature independent and one temperature dependent, is discussed. (C.R.)

1583

Los Alamos Scientific Lab.

THE BIOLOGICAL EFFECTIVENESS OF THERMAL NEUTRONS IN INHIBITING MITOSIS IN MICE, by John Storer. Nov. 1952. 25p. (LA-1400)

Mice were exposed to low doses of x and thermal-column radiation (thermal neutrons plus gamma contaminant). At intervals following exposure, determinations were made of the mitotic index of the ear epithelium of the mice. Following an initial period of depression, the mitotic index returned to normal levels. The log of the time intervals at which normal values were reattained varied directly with the dose of radiation. With the dose of thermal column exposure expressed in rem (based on the value found in acute lethality studies), the resulting dose-response regression line was not significantly different from the dose-response line for the x-irradiated animals. It was concluded therefore that thermal-column exposure was equally effective in producing acute lethality and inhibition of mitosis. If it was assumed that the gamma contaminant in the thermal column exposure was also equally effective in producing lethality and mitotic inhibition, then the relative effectiveness of thermal neutrons was concluded to be approximately 1.7, approximately the same value as was found in other experiments using different test systems. (auth)

1584

Naval Medical Research Inst., Bethesda

EFFECTS OF TOTAL BODY X-RADIATION ON SALIVARY COMPONENTS OF DOGS, by J. L. Nemes, M. G. Wheatcroft, and R. S. Leopold. Naval Medical Research Inst., Bethesda and Maryland Univ. July 29, 1952. 9p. (NM-008-012.04.02)

A study of the salivary components of 14 dogs exposed to total-body x radiation doses of 200, 400, and 600 r indicated decreases in mean P and N content of the dogs' saliva following irradiation. Lysozyme activity and acidity of salivas increased following irradiation. Variations between pre- and post-irradiation-assayed quantities do not indicate feasibility of utilizing these tests as diagnostic aids for radiation exposure. (auth)

1585

Radiation Lab., Univ. of Calif., Berkeley

THE METABOLIC PROPERTIES OF VARIOUS MATERIALS AND THE PATHOLOGICAL EFFECTS OF ASTATINE, p.84-104 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT FOR JULY, AUGUST, AND SEPTEMBER, 1952. Nov. 10, 1952. 21p. (UCRL-2001(p.84-104))

Experiments involving attempts to remove Pu from rats by the use of the Ca salt of Versene have been continued and data are included on effects of Versene on tissue distribution and excretion of Pu^{238} following intravenous injection. The preparation of F^{18} is described and data on tissue distribution and excretion of carrier-free F^{18} administered intravenously to rats are presented. The case history and autopsy findings are reported of a young male Rhesus monkey which had received 100 μc of At by injection into the anterior chamber of the eye approximately two years prior to sacrifice and an exit dose of 100 μc of carrier-free radioiodine by intraperitoneal injection 24 hr prior to sacrifice. Effects of At on morphology and function of the thyroid gland are discussed in detail. (C.R.)

1586

WHITE NONSPORING MUTANTS OF PENICILLIUM

NOTATUM CHRYSOGENUM INDUCED BY RADIOACTIVITY. M. L. Gattani. Current Sci. (India) 21, 167-8(1952) June.

Monosporous cultures of P. notatum chrysogenum were grown on potato dextrose agar media containing 0.5 and 1.0 g U nitrate/l. When growth commenced on this medium, the actively growing mycelia were transferred to media containing higher concentrations of U nitrate. It was concluded that radioactive emissions from U nitrate promote the production of white, mycelial nonsporing mutants which produce less penicillin than their parents in the strain of penicillium studied. (C.R.)

1587

THE SENSITIVITY OF LYMPHOCYTES TO IONISING RADIATION. O. A. Trowell. J. Path. Bact. 64, 687-704(1952) Oct.

The small lymphocytes of lymphoid tissue are the most radiosensitive cells in the body, but they are non-dividing cells and the reason for their sensitivity is unknown. The cytological chahges produced in lymphocytes by x rays are described; they are non-specific and give no clue to the site of radiation damage. There is nuclear pyknosis but no destruction of mitochondria and no swelling of nucleus or cytoplasm. Using the method of lymph-node culture previously described (Trowell) the radiosensitivity of lymphocytes in vitro was compared with that of similar cells in the whole animal. Cell counts made from wet-fixed film preparations of the nodes gave the percentage of lymphocytes which were pyknotic 5 hr after various doses of x rays. The dose-effect curve plotted on logarithmic-probability paper gave a straight line. The ED 50 (dose required to produce 50% pyknosis in 5 hr) was 275 r in vitro and 150 r in vivo. The range of cell sensitivity was wider in vitro than in vivo. It is concluded that the high sensitivity of lymph-node lymphocytes is a property of the cells themselves and that "indirect" effects of radiation are slight or non-existent. Medium lymphocytes were found to have much the same sensitivity as small lymphocytes. Reticular cells (macrophages), monocytes, and plasma cells were unaffected by doses up to 800 r. Whole blood was cultured and irradiated in vitro by methods similar to those used for lymph nodes. The ED 50, determined in the same way, was 1600 r. Blood lymphocytes are therefore less sensitive than lymph-node lymphocytes, but not as insensitive as others have claimed. In contrast to the negative findings of others, pyknotic lymphocytes were found in the peripheral blood in considerable numbers after 400 r whole-body x irradiation. A peak of 7% was reached 3 hr after irradiation. It was concluded that pyknotic lymphocytes are rapidly removed from the blood stream, mostly by the lungs, where they were found lodged in the alveolar capillaries. Pyknotic counts of the scattered lymphocytes in the intestinal villi of animals killed 5 hr after various doses of x rays showed that the ED 50 for these cells was 2250 r. (auth)

1588

THERMAL-NEUTRON INDUCED EFFECTS IN F_1 MAIZE PLANTS. John Wesley Schmidt. Ph.D. Thesis, Univ. of Nebraska, 1952.

Investigations were made of the comparative effects of exposing maize seed and maize pollen in the Argonne heavy-water reactor in order to determine the effective radiations obtained from the reactor, the effects of exposing maize pollen in the nuclear reactor on subsequent mature F_1 plant development, and the feasibility of using the irradiation-induced chromosomal aberrations to locate genetic factors influencing certain plant characters. Data are compared with previously collected x-irradiation data, and possible explanations for the biological effects of neutrons are discussed. (C.R.)

1589

HYPOTHERMIA AND INCREASED SURVIVAL RATE OF INFANT MICE IRRADIATED WITH X-RAYS. John B. Storer and Louis H. Hempelmann. Am. J. Physiol. 171, 341-8(1952) Nov.

The survival of infant mice irradiated while in a state of extreme hypothermia (about 5°C) is almost twice that of litter mates exposed to the same doses of total-body x rays at room temperature. The mortality rate was not affected in infant animals less severely chilled, nor in adult mice chilled after being anesthetized. The protection afforded by extreme chilling was of about the same degree as that produced by placing the animals in a nitrogen atmosphere; furthermore, combining anoxia with refrigeration did not enhance the radiation protection. The benefit derived from extreme chilling was less if animals were placed in pure oxygen rather than in nitrogen. It is concluded that lowered tissue oxygen played an important, if not a crucial, role in increasing the survival rate of chilled infant mice. 17 references. (auth)

1590

RESTORATIVE ACTION OF PEROXIDASE ON IRRADIATED BACTERIA. Raymond Latarjet. Compt. rend. 235, 1701-2 (1952) Dec. 22. (In French)

Peroxidase, like catalase, restores certain bacteria sterilized by strong doses of ultraviolet rays. This restoration seems to result from the enzyme catalyzing the oxidation of organic substrates by radiation-produced peroxides, thus diverting the latter from the processes of cellular alteration. (tr-auth)

1591

NITROGEN METABOLISM FOLLOWING WHOLE BODY X-RADIATION. Gordon E. Gustafson and Simon Koletsky. Am. J. Physiol. 171, 319-24(1952) Nov.

For the first 6 days following 660 r of whole-body x radiation rats are in marked negative N balance. This cannot be accounted for on the basis of decreased food intake alone. Additional factors are tissue destruction and probably alteration in metabolism due to radiation. A second period of negative N balance may occur in radiated rats during the second or third week post-radiation. Here blood loss or infection may be contributing factors. Water intake in the 660-r x-radiated rats decreased markedly on the second and third day post-radiation while the intake of the control rats increased markedly. Urinary output in both groups followed the same trend as the water intake. For the first 3 days following whole-body x radiation, rats which received 660 r showed a greater N excretion and a more negative N balance than did animals which received 1000 r. (auth)

1592

ANOMALIES OCCURRING IN CHILDREN EXPOSED IN UTERO TO THE ATOMIC BOMB IN HIROSHIMA. George Plummer. Pediatrics 10, 687-93(1952) Dec.

A study was carried out on 205 $4\frac{1}{2}$-yr-old children who had been exposed to the atomic bomb blast during the first half of intrauterine life. Eleven were exposed within 1200 m of the bomb hypocenter, and the remaining 194 were beyond this distance. Seven of these 11 children exposed within 1200 m had microcephaly with mental retardation. This diagnosis was not made on any of the 194 children exposed at greater distances. Correlation between head size and mental development of the child with distance from the hypocenter, symptoms of radiation effect and type of shielding of the mother is discussed. The conclusion drawn from the present study is that central nervous system defects can be produced in the fetus by atomic bomb radiation, provided that exposure occurs within approximately 1200 m of the hypocenter and that no effective shielding, such as concrete, protects the fetus from direct irradiation. (auth)

1593

INDIRECT INACTIVATION OF BACTERIOPHAGE DURING AND AFTER EXPOSURE TO IONIZING RADIATION. Tikvah Alper. Discussions Faraday Soc., No. 12, 234-43(1952).

Bacteriophages S13 and T3 have been irradiated with x rays, γ rays, and ultraviolet light while suspended, in varying concentrations, in buffer solution. The problems studied included variation of inactivation dose with concentration, shape of survival curves, inactivating effect of H_2O_2 and aftereffect of radiation. Phage particles surviving irradiation (with ionizing rays) in dilute solution were found to be much more susceptible thereafter to the inactivating effect of H_2O_2. This change in the phage particles is an indirect effect of radiation, but could not be attributed to the action of OH or HO_2 radicals. (auth)

1594

DIVISION DELAY BY RADIATION AND NITROGEN MUSTARD IN PARAMECIUM. R. F. Kimball, R. P. Geckler, and Nenita Gaither. J. Cellular. Comp. Physiol. 40, 427-59(1953) Jan.

Division delay by ultraviolet, x rays, or nitrogen mustard in Paramecium is shown to involve a retardation not only in the first interval after treatment but also in later intervals. The effect upon the first interval is more marked, relative to that upon later intervals, with x rays and nitrogen mustard than it is with ultraviolet. At low doses, the 3rd, 4th, and sometimes the 5th intervals of a given line of descent are longer than the second interval. At high doses, some one interval, usually the 3rd or 4th, is often very long, sometimes lasting as long as two or three weeks. When no interval is very long, two or more intervals are of intermediate duration. Different treated animals and even different lines of descent from the same treated animal may differ in which interval is the longest. Recovery of the normal rate is usually nearly complete by the 6th division. The distribution of the delay to the various division intervals changes only slightly with dose. (auth)

RADIATION HAZARDS AND PROTECTION

1595

HARMFUL EFFECTS OF X RAYS AND RADIOACTIVE EMANATIONS FROM THE POINT OF VIEW OF LEGAL MEDICINE (CONTINUED). Rodolfo Bramanti Jauregui. Rev. sanid. milit. Argentina 51, 287-304(1952) July-Sept. (In Spanish; cf. NSA 7-42)

Legal aspects of industrial radiation injuries and the responsibilities of radiology and radiotherapy establishments are considered, particular attention being paid to provisions of the Argentine civil code. (G.Y.)

RADIOTHERAPY

1596

Brookhaven National Lab.

SMALL RADIOACTIVE SPHERES FOR POSSIBLE USE IN MEDICAL OR BIOLOGICAL INVESTIGATION, by L. P. Hatch. Nov. 1952. 2p. (BNL-1329)

An investigation is briefly reported on the possibilities of combining the elements produced by the fissioning of U with stable montmorillonite clay for the fabrication of radiation sources of various sizes, shapes, and radiation characteristics for use in medical and biological investigations. (C.R.)

1597

Radiation Lab., Univ. of Calif., Berkeley

MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT FOR JULY, AUGUST, AND SEPTEMBER, 1952. Nov. 10, 1952. 134p. (UCRL-2001)

Separate abstracts have been prepared on three sections of this report. (See UCRL-1922 for previous quarter).

1598

Radiation Lab., Univ. of Calif., Berkeley

THE PHYSIOLOGY AND TREATMENT OF POLYCYTHEMIA VERA, p.3-83 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT FOR JULY, AUGUST, AND SEPTEMBER, 1952. Nov. 10, 1952. 81p. (UCRL-2001(p.3-83))

The clinical picture, physiology, pathology, treatment, and prognosis based on experience with 201 patients with polycythemia vera are discussed. Practically all patients were treated with P^{32} alone or in combination with venesection. A report is also included of studies of secondary and relative polycythemia and their relation to polycythemia vera. Included is a summary of hematological data on the native inhabitants of the Peruvian highlands. 128 references. (C.R.)

TRACER APPLICATIONS

1599

Oberlin Coll.

THE INFLUENCE OF TEMPERATURE AND ILLUMINATION ON THE EXCHANGE OF POTASSIUM ION IN ULVA LACTUCA, by George T. Scott and Hugh R. Hayward. Oberlin Coll. and Marine Biological Lab., Woods Hole. [nd] 9p. (AECU-2357)

Methods for the use of K^{42} in studying the exchange of K ion in the green alga Ulva lactuca are described, and the effects of illumination and temperature on the dynamics of this exchange are presented. Conditions of illumination and increased temperature each markedly increase the exchange rate. The data indicate a complete exchange of cellular for environmental K; this exchange in illuminated Ulva is much more rapid than that in the erythrocyte, and of the same order of magnitude as is found in actively fermenting yeast. An interpretation of the data is presented. The role of cellular metabolism in regulating the K distribution is emphasized. (auth)

1600

Harvard School of Dental Medicine

SUMMARY REPORT ON STUDIES ON THE METABOLISM OF THE TEETH, by Reidar F. Sognnaes and James H. Shaw. Dec. 1, 1952. 16p. (AECU-2359)

A series of experiments on the interactions between saliva, enamel, dentin and the internal blood supply of the teeth has been conducted. The first problem to be explored has been conclusively answered to the effect that the enamel of P^{32}-injected monkeys attains its major radioactivity from a direct contact with salivary P^{32} per se. Two P^{32} gradients have been observed in the teeth of intact rhesus monkeys following intravenous P^{32} administrations: one increasing from the internal to the external enamel surface, the other increasing from the external to the internal dentin surface. The former gradient could be nearly completely abolished by avoiding contact between the enamel and the salivary P^{32} secretion, the latter by removal of the pulpal P^{32} supply to the teeth. The P^{32} uptake of enamel was greater in young than old teeth, lower in extracted than vital teeth, and was reduced in teeth exposed to radioactive saliva containing 20% sucrose. Observations on P^{32}, which forms an integral part of the tooth, have more recently been compared with the distribution of radioisotopes, such as radioiodine and tritiated water which give clues to processes of diffusion. Measurements of radioactivity have been made with procedures described in detail in published works. In addition, we have continued to refine the radioautograph technique, exploring the application of ultra-thin section. (auth)

1601

California Univ., Davis

THE AVAILABILITY OF THE PHOSPHORUS IN ALFALFA HAY, by G. P. Lofgreen and Max Kleiber. [nd] 10p. (AECU-2360)

A study is described in which the true digestibility of the phosphorus in alfalfa hay is determined using five lambs as experimental animals. It was found that an average of 88 percent of the fecal phosphorus of lambs fed alfalfa hay was of metabolic origin and 12 percent was undigested phosphorus

from the hay. While the apparent digestibility of the phosphorus of the hay averages 22 percent, the true digestibility was 91 percent indicating that the phosphorus in the alfalfa hay used in this study was highly available for absorption by lambs. (auth)

1602

Louisiana State Univ.

DETECTION OF MICROBIAL TOXINS BY THE USE OF RADIOISOTOPES, by H. E. Wheeler. [nd] 12p. (ORO-85)

A direct test of the toxin theory of plant disease requires the development of methods by which toxins produced within host tissues can be detected and distinguished from host reaction products. The use of plant pathogens, tagged with appropriate radioisotopes, for the production of labeled toxins within the host has been suggested as an approach to this problem. Theoretical considerations and limited experimental data indicate that such an approach is feasible. C^{14} and tritium appear to be the most generally useful radioisotopes for the production of labeled toxins. Autoradiography and chromatography appear promising as methods for the detection and assay of labeled toxins produced within host tissues by tagged plant pathogens. (auth)

WASTE DISPOSAL

1603

APPLICATION OF BIOLOGICAL METHODS IN THE TREATMENT OF RADIOACTIVE WASTES. C. C. Ruchhoft and L. R. Setter. Sewage and Ind. Wastes 25, 48-60(1953) Jan.

General aspects of radioactive waste disposal problems are reviewed and the use of biological methods (activated sludge and trickling filter) in the treatment of such wastes are discussed. (C.R.)

CHEMISTRY

1604

Laboratory for Nuclear Science, Mass. Inst. of Tech.

TWENTY-SEVENTH PROGRESS REPORT [FOR] PERIOD AUGUST 31, 1952 TO NOVEMBER 30, 1952. Nov. 30, 1952. 59p. (AECU-2347)

Separate abstracts have been prepared for four sections of this report. (See NP-4119 for previous quarters).

1605

Laboratory for Nuclear Science, Mass. Inst. of Tech.

NUCLEAR CHEMISTRY (INORGANIC) GROUP and NUCLEAR CHEMISTRY (ORGANIC) GROUP, p.15-29 of TWENTY-SEVENTH PROGRESS REPORT FOR PERIOD AUGUST 31, 1952 TO NOVEMBER 30, 1952. Nov. 30, 1952. 15p. (AECU-2347(p.15-29))

Progress is briefly reported on the following studies: solvent extraction of Ge(IV), electrochemical separation on a rotating ion-exchange membrane belt, Mo^{101} and Tc^{101} decay schemes, search for Pb^{205}, relative γ cross sections in Ce^{142}, angular asymmetry of photofission products of Th^{232}, and carbonium ion rearrangements. (L.T.W.)

1606

Wisconsin Univ.

THE RATE LAW AND MECHANISM FOR THE REACTION OF CERIUM (IV) AND BROMIDE ION IN AQUEOUS SULFATE MEDIA, by Edward L. King and Mary L. Pandow. [nd] 25p. (AECU-2364)

Cerium (IV) and bromide ion react in aqueous acidic sulfate media to form cerium (III) and bromine at a conveniently measurable rate. The reaction has been studied spectrophotometrically at 25°C; the rate of reaction conforms to the rate equation

$$-\frac{d(Ce^{IV})}{dt} = \frac{(Ce^{IV})}{(SO_4^{--})}\left|k'_{12}(Br^-)^2 + k'_{11}(Br^-)\right|.$$

Since the dominant species of cerium (IV) in the solutions under consideration contains three sulfate ions and no bromide ions, the two important activated complexes have the compositions $Ce(SO_4)_2Br_2^{--}$ and $Ce(SO_4)_2Br^-$. Activated complexes involving fewer than two sulfate ions are also important at the low end of the sulfate ion concentration range. Chloride ion catalysis is observed; an activated complex of the composition $Ce(SO_4)_2ClBr^{--}$ is important in chloride media. The presence of lithium ion accelerates the reaction noticeably. (auth)

1607

Argonne National Lab.

EQUIVALENT CIRCUIT MODEL OF THE TRANSFERENCE CELL, by George W. Murphy. Dec. 1952. 25p. (AECU-2378; UAC-685)

An equivalent circuit model is proposed for a cell with reversible electrodes in contact with a solution of a suitable binary electrolyte, nonuniform in concentration. The capacitance part of the circuit is related to the free-energy change of the dilution process, while the resistance parts are related to the cation and anion transports. The model leads directly to familiar equations and suggests a new technique of cell measurement for deriving thermodynamic properties. (auth)

1608

Brookhaven National Lab.

PREPARATION OF SPHERICAL CLAY PARTICLES CONTAINING RADIOACTIVE IONS, by William S. Ginell and George P. Simon. Nov. 1952. 12p. (BNL-1277)

In a study of the problem of the ultimate disposal of radioactive nuclear fission waste products, it was found possible to replace the naturally occurring exchangeable cations in mineral montmorillonite clay by fission-product cations. On thermally altering the mineral structure, the exchange properties were lost to a great extent and the radioactive ions were rigidly bound within the particles of the resulting mineral. The thermal treatment, which results in particles of spherical shape, is described and a drawing of the apparatus used for the production of the clay spheres is included. The use of the isotope-impregnated clay spheres as radiation sources for inert insoluble tracer studies and for medical and biological uses is discussed. It is pointed out that with such sources it is possible to standardize the physical features of the source while varying the half life, the type, the energy, and the specific activity of the radiation. A partial list of elements which would be chemically suitable for incorporation into montmorillonite, and the specific activities and nuclear data on the elements, are included. This report is a revision of BNL-1105 (NSA-6-2368). (C.R.)

1609

Los Alamos Scientific Lab.

MATHEMATICAL STUDIES ON GALVANIC CORROSION. PART I. COPLANAR ELECTRODES WITH NEGLIGIBLE POLARIZATION, by J. T. Waber. Nov. 17, 1952. 29p. (LA-1488)

The distribution of potential within an electrolyte produced by a coplanar arrangement of electrodes has been determined mathematically. Only the limiting case of negligible anodic and cathodic polarization is considered. The distribution of corrosion attack on the anode has been derived from this potential distribution. Quantitative agreement between these theoretical results and Copson's experimental data for a similar arrangement of electrodes is shown to be poor. (auth)

1610
Illinois Inst. of Tech.
STUDIES OF FAST REACTIONS WHICH EVOLVE GASES. THE REACTION OF SODIUM-POTASSIUM ALLOY WITH WATER IN THE PRESENCE AND ABSENCE OF OXYGEN, by Martin Kilpatrick, Louis L. Baker, Jr., and C. Dana McKinney, Jr. Oct. 1952. 27p. (NP-4215; Technical Report No. 6; U-25213)

An improved apparatus has been developed for following simultaneously the pressure and ignition of reactions evolving gases. Both the early technique and the improved method have been applied to the reaction of Na-K alloy with H_2O in the presence and absence of O_2. It has been found that if O_2 is present there is an interesting example of ignition delay which explains the second pressure rise reported previously. When the excess of H_2O relative to the alloy is reduced sufficiently, ignition takes place on contact and only one maximum is recorded, corresponding to the second pressure rise. In the absence of O_2 a single maximum is recorded, corresponding to the first pressure rise reported previously. The improved apparatus permits the contacting of one ml of each of the reactants in 2 msec. A possible limitation to the speed with which chemical reactions may be followed by measuring their pressure is discussed. The reaction of Na-K alloy with ethanol, the hydrolysis of Al borohydride, and the hydrolysis of triethyl dialane are reported. (auth)

ANALYTICAL PROCEDURES

1611
Oak Ridge National Lab.
NEUTRON ACTIVATION ANALYSIS: A USEFUL ANALYTICAL METHOD FOR DETERMINATION OF TRACE ELEMENTS, by G. W. Leddicotte and S. A. Reynolds. Issued Jan. 2, 1953. Decl. Jan. 27, 1953. 30p. (AECD-3489; ORNL-1443)

The application of neutron activation analysis to the determination of trace elements as impurities in many substances is reviewed. The method of activation analysis is prefaced by a generalization of the types of nuclear interactions occurring in the ORNL reactor. The utility of this type of analysis, its detection limits, and other pertinent facts are appraised. (auth)

1612
Carbide and Carbon Chemicals Co. (Y-12)
COLORIMETRIC DETERMINATION OF ZIRCONIUM, by H. G. King and W. H. Owens. Oct. 27, 1952. Decl. with deletions Jan. 27, 1953. 11p. (AECD-3491; Y-917)

An adaptation of the alizarin lake method for determining Zr in the presence of U is presented. The method depends largely upon the purification procedure, which assures the removal of common interferences. Fluoride and phosphate are removed by volatilization, and sulfate effect is eliminated by calcium chloride. Uranium is oxidized to U(VI), and does not interfere at the wavelength utilized. Impure U-Zr solutions may be analyzed quite rapidly with accuracy of within ±2%. (auth)

1613
Pennsylvania State Coll.
POLAROGRAPHIC ANALYSIS OF MIXTURES OF FUMARIC AND MALEIC ACIDS, AND THEIR DIETHYL ESTERS, by Philip J. Elving, Aaron J. Martin, and Isadore Rosenthal. [nd] 13p. (AECU-2356)

A polarographic method for the analysis of mixtures of fumaric and maleic acids, and their diethyl esters is described. In the absence of the acids, the esters can be measured directly. (auth)

1614
Commissarist à l'Énergie Atomique (France)
DOSAGE COLORIMETRIQUE DE L'ION FLUOR—APPLICATION À L'URANIUM METAL ET AU FLUORURE URANEUX. (COLORIMETRIC DETERMINATION OF THE FLUORIDE ION—APPLICATION TO URANIUM METAL AND TO URANOUS FLUORIDE), by H. Hering, J. Hure, and S. Legrand. Dec. 1949. 20p. (CEA-26)

In the determination described for fluoride in U metal, the U is brought into H_2SO_4 solution by anodic oxidation, the fluosilicic acid is distilled by entrainment in water vapor, and the F ion is determined in the distillate by using the fact that it complexes Zr and thus prevents the formation of the Zr–alizarin S lake. For F ion in UF_4, the compound is dissolved in a Na_2CO_3-H_2O_2 mixture, and F is determined in the solution by the colorimetric method described. (tr-auth)

1615
Department of Mines and Technical Surveys, Mines Branch, Ottawa (Canada)
THE AMPEROMETRIC DETERMINATION OF SULPHATE, by A. Hitchen. Dec. 17, 1952. 11p. (NP-4341; TR-106/52)

A method is described for the amperometric titration of sulfate directly in solutions containing Na_2CO_3 and Na_2SO_4. The method is rapid with a reasonable degree of accuracy and reproducibility. Interfering elements in these solutions, with the exception of carbonate and bicarbonate, are absent or present only in negligible amounts. Carbonate and bicarbonate are easily removed by decomposition with nitric acid. (auth)

1616
ANALYSIS OF LIGHT ALUMINUM-BASE ALLOYS BY SPECTROPHOTOMETRIC METHODS. II. M. Jean. Anal. Chim. Acta 7, 523-60(1952) Dec. (In French)

Colorimetric methods of analysis of light alloys of Al have been examined by the spectrophotometric method. In particular, four methods of determination of Fe have been studied. The method which makes use of sulfophenyl pyrazolone carboxylic acid is recommended; the accuracy is of the same order as that of the phenanthroline method, and the reagent is a much-used product and is less expensive than phenanthroline. Simple and rapid methods are proposed for the determination of Cr, Co, and Ti, and studies have been made leading to relatively new and original techniques for Bi, Sn, and Zr. (auth)

1617
DETERMINATION OF TRACES OF COBALT IN SOILS; A FIELD METHOD. Hy Almond. Anal. Chem. 25, 166-7 (1953) Jan.

The determination is based on the fact that cobalt reacts with 2-nitroso-1-naphthol to yield a pink compound that is soluble in carbon tetrachloride. The carbon tetrachloride extract is shaken with dilute cyanide to complex interfering elements and to remove excess reagent. The cobalt content is estimated by comparing the pink color in the carbon tetrachloride with a standard series prepared from standard solutions. The cobalt 2-nitroso-1-naphtholate system in carbon tetrachloride follows Beer's law. As little as 1 ppm can be determined in a 0.1-gram sample. (auth)

1618
ANALYTICAL METHODS FOR GERMANIUM. Horatio H. Krause and Otto H. Johnson. Anal. Chem. 25, 134-8(1953) Jan.

This review summarizes the qualitative and quantitative methods for determining Ge. The majority of the methods require a preliminary separation of the Ge either by distillation as the halide or by precipitation. Quantitative procedures include gravimetric, volumetric, colorimetric, polarographic, and spectrographic. Most procedures are applicable only in specific cases and the selection of the method is determined by the nature of the interfering substances present. (auth)

1619
DETECTION AND DETERMINATION OF THALLIUM. J. R. A. Anderson. Anal. Chem. 25, 108-12(1953) Jan.

The analytical chemistry of Tl, covering methods disclosed in the literature mainly over the period of 1940 to 1950, is reviewed. The detection of Tl by spectrographic, fluorescence, and micromethods is described. The quantitative determination of Tl by many gravimetric methods and the use of the thermobalance for the gravimetric estimation of various compounds of Tl are dealt with. The volumetric determination of thallous salts by oxidation methods is discussed, while the application of spectrography, polarography, radioactivity, and chromatography to the determination of Tl, and methods for its potentiometric, conductometric, and electrolytic estimation also receive some attention. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1620
Cornell Univ.
STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS, by J. L. Hoard. Jan. 2, 1953. 7p. (NYO-931)

Accurate lattice constants were determined for a number of specimens. An approximate structure for dimethylaminoborine dimer, based on the space group C2/m and assigning a cyclobutane-like configuration to the molecule, accounts rather well for Patterson and some Fourier syntheses. The minimum required molecular symmetry is 2/m, but the approximate structure assigns to the skeleton of B, N, and C atoms substantially the higher symmetry of mmm. This corresponds to a square B-N ring with equal bond distances and angles. There remain, however, serious discrepancies between calculated and observed amplitudes for some reflections so that the molecule may well be considerably distorted from the "ideal" model. The lattice constants of the hexagonal cell of the fluorocarbon C_6F_{10} are a = 6.9, c = 11.2 A, corresponding nearly to the axial ratio for hexagonal closest-packing of spheres. This last fact suggests that the "molecular rotation" may not be limited to rotation about the three-fold axis. (auth)

1621
A CORRECTION AND NOTE ON THE STRUCTURE OF $TiBe_{12}$. Richard F. Raeuchle and R. E. Rundle. Acta Cryst. 6, 107 (1953) Jan. 10.

Certain errors in the paper by Raeuchle and Rundle (Acta Cryst. 5, 85(1952); NSA 5-3086) on the structure of $TiBe_{12}$ are corrected. The proposed structure still gives the best fit between observed and calculated intensities that can be obtained at present, but other interpretations are not ruled out entirely. (G.Y.)

1622
RARE EARTH TITANATES WITH A PEROVSKITE STRUCTURE. J. Brous, I. Fankuchen, and E. Banks. Acta Cryst. 6, 67-70(1953) Jan. 10.

A mixed oxide of Eu and Ti, in which the Eu is apparently divalent, has been prepared by heating Eu_2O_3 with TiO_2 in a reducing atmosphere. The product is isostructural with $SrTiO_3$ and has almost exactly the same lattice constant. No phase changes occurred down to 108°K. It was found that the reaction does not occur in an oxidizing or neutral atmosphere, which increases the likelihood that it is a compound of Eu(II), which should have about the same ionic radius as Sr(II). This is the first known case of the existence of Eu(II) in an oxide lattice. A series of compounds which are isostructural with $SrTiO_3$ have been prepared with the Si^{++} replaced by La^{+3} and one of the alkali cations Li^+, Na^+, K^+, and Rb^+. No such compound was formed with Cs^+. By leaching with hot water, it was determined that the fraction of alkali cation entering the lattice decreased with increasing ionic size. The x-ray diagrams indicate a progressive increase in lattice constant up to the K compound. The Rb compound has almost the same lattice constant as the K compound, because the increase in ionic size is compensated by a decrease in the extent of solid solution. (auth)

FLUORINE AND FLUORINE COMPOUNDS

1623
Kansas Univ.
THE DISSOCIATION ENERGY OF FLUORINE, by Paul W. Gilles and John L. Margrave. [nd] 4p. (AECU-2366)

The pressure exerted by a sample of F_2 when contained in a closed system was measured as a function of temperature over the range 300 to 860°K. For temperatures below 800°K the pressure calculated on the basis of no dissociation of an ideal gas agreed with the experimentally observed pressures. Measurements at 810, 815, and 860°K showed substantial differences between observed and calculated pressures. Values for the degree of dissociation, dissociation equilibrium constant, and dissociation energy are tabulated, from which the average dissociation energy is calculated to be 31.5 ± 0.9 kcal/mole. Comparison of this value with that obtained by other workers yields an apparent best value of 36 ± 3 kcal/mole. By use of a F_2 electron affinity of 82 ± 3, derived experimentally, and other standard thermochemical data, a value of 31 ± 4 kcal/mole is derived for the dissociation energy, in agreement with the experimental results. (L.T.W.)

1624
NOTE ON CERTAIN ALIPHATIC FLUORINE COMPOUNDS. VI. E. Gryszkiewicz-Trochimowski and O. Gryszkiewicz-Trochimowski. Bull. soc. chim. France, 123-4(1953) Jan. (In French)

Tetrakis(fluoromethyl)methane, $(FCH_2)_4C$, was prepared by the action of KF on the tetrabromo derivative of pentaerythritol. The action of KF on the tribromo derivative did not lead to the formation of the corresponding trifluoro derivative, HF and CH_2O being split off to form various products. (G.Y.)

1625
THE FORMATION OF NEGATIVE IONS OF SULFUR HEXAFLUORIDE. A. J. Ahearn and N. B. Hannay. J. Chem. Phys. 21, 119-24(1953) Jan.

Negative ion production in SF_6 has been studied in a mass spectrometer; SF_6^-, SF_5^-, F_2^-, and F^- were identified. The SF_6^- and SF_5^- are produced in very large quantities by a resonance capture process at an electron energy of about 2 ev, and are formed in approximately equal amounts. At higher electron energies, the same capture occurs by a secondary process, in which low energy electrons released by other excitation and ionization processes suffer the resonance capture. Partial dissociation after electron capture accounts for the appearance of F^- and F_2^- ions below 16 ev. Above this energy, other processes will also produce these ions. Possible explanations of the primary resonance capture mechanism are discussed. (auth)

1626
FLUORINE TECHNOLOGY. J. P. Baxter. Revs. Pure and Appl. Chem. (Australia) 2, 203-11(1952) Dec.

This review is concerned with the industrial production of elementary F. The general problems that arise in the handling and utilization of F are included, and reference is made to control analysis, disposal, and toxicity problems. 17 references. (L.T.W.)

LABORATORIES AND EQUIPMENT

1627
Vitro Corp. of America
QUARTERLY PROGRESS REPORT [FOR] OCTOBER–

DECEMBER, 1952; DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT; JOB 24-A. Jan. 29, 1953. 11p. (KLX-1383)

Incomplete results of field trials of laboratory radioactive waste disposal units are presented. No technical data are included. (C.R.)

RADIATION CHEMISTRY

1628

Argonne National Lab.

FREE RADICAL INITIATED CHAIN CONVERSION OF DISSOLVED ISOTOPICALLY ENRICHED OXYGEN TO NORMAL OXYGEN IN AQUEOUS SOLUTION, by Edwin J. Hart, Sheffield Gordon, and Dwight A. Hutchison. Dec. 12, 1952. 5p. (AECU-2376; UAC-681)

The effect of γ dosage rate, concentration of enriched O_2, and concentration of hydroxyl ion and H_2O_2 on the $O^{16}O^{18}$-H_2O^{16} exchange reaction is discussed. The disappearance of enriched O_2 follows a first order reaction that is modified by the formation of H_2O_2. The yield of normal O_2 increases with pH and is independent of dosage rate in the range 2.76×10^{16} to 2.19×10^{20} ev/l-min. The yields of normal O_2 vary from 0.64 at pH = 2.15 to 111 at pH = 12.65. In alkaline solution a sharp rise in the curve occurs in the region above pH = 9.0. It is calculated that at pH = 12.65 as many as 40 enriched O_2 molecules are converted to normal O_2 molecules/radical pair formed in the solution. H_2O_2 added initially to the solution causes a decrease in the isotopic exchange reaction at pH = 11.6. No evidence was found of a thermal exchange reaction between dissolved enriched O_2 and normal O_2 of the water at pH = 11.88 over a period of 119 hr at room temperature. (L.T.W.)

1629

Brookhaven National Lab.

A TEST FOR THE INFLUENCE OF RADIATION DECOMPOSITION ON RETENTION IN THE SZILARD-CHALMERS REACTION, by William H. Hamill and Russell R. Williams, Jr. Brookhaven National Lab. and Notre Dame Univ. [nd] 13p. (BNL-1303)

The decrease in retention produced by Cl_2 and the increase produced by allyl chloride appears to be experimentally identical under the three conditions of bombardment used. The total external radiation dose received by the samples was varied over a range of $\sim 5 \times 10^3$ and the rate of dosage over a range of $\sim 10^5$. In chlorine compounds, however, the self-radiation due to the capture γ rays from $Cl^{35}(n,\gamma)Cl^{36}$ (σ = 50 barns) is even more important than the general radiation of the pile. (auth)

1630

Yale Univ.

PROGRESS REPORT NO. 4 [ON] EFFECT OF GAMMA RADIATION ON HYDROCARBON GASES [FOR] THIRD QUARTER, 1952. Oct. 30, 1952. 14p. (NYO-3311; Progress Report No. 4)

The nature of the effect of temperature on the γ-initiated polymerization of ethylene, below temperatures at which a significant amount of thermal polymerization would occur, has been investigated. Polymerization rate data have been obtained at nearly atmospheric pressure in a pyrex glass reaction vessel, having a surface-volume ratio of about 1.8 cm^{-1}, at six temperatures between 88 and 372°F. The rate data were derived from total-pressure measurements made on a batch system of ethylene. It was assumed, on the basis of the results of certain preliminary runs, that the extent of formation of gaseous products was negligible. The polymerization rate was found to be essentially independent of temperature in the range of 80 to 175°F. Above 175°F, the increase in polymerization rate accompanying an increase in temperature corresponded to an apparent activation energy of the order of magnitude of 7 kcal/g-mole. Preliminary investigation of the effect of pressure, nature, and extent of surface, source of acetylene on the γ-initiated polymerization of acetylene has been carried out and tentative conclusions are presented. (Previous report NYO-3310) (auth)

1631

Radiation Lab., Univ. of Calif., Berkeley

HIGH ENERGY HELIUM-ION IRRADIATION OF AQUEOUS ACETIC ACID SOLUTIONS, by Warren M. Garrison, Herman R. Haymond, Donald C. Morrison, Boyd M. Weeks, and Jeanne Gile-Melchert. Dec. 1, 1952. 30p. (UCRL-1863)

A detailed study has been made of products formed in aqueous acetic acid solutions by reactions resulting from irradiation with cyclotron-produced He ions having an energy of 35 Mev. Reaction yields (molecules produced per 100 ev absorbed) have been determined under certain conditions of beam intensity, total energy absorption, volume, and concentration of acetic acid, H_2O_2, and O_2. The gaseous products, which include H_2, CO_2, CH_4, and CO, were determined by mass spectrometric methods. H_2O_2 production in O_2-saturated systems is a linear function of the total energy absorbed in the solution. Organic peroxides could not be detected. The nonvolatile fraction is composed principally of dibasic and tribasic acids. Succinic acid accounts for over 98% of the nonvolatile acidity at radiation levels below about 1×10^{20} ev/cm^3. Tricarballylic, citric, malic, and malonic acids, in addition to succinic acid, are produced at higher radiation levels. Identification and yield determinations were facilitated by the addition of $CH_3C^{14}OOH$ to the target solution. The nonvolatile acids were separated and subsequently identified by the use of techniques involving several different methods of partition chromatography on silica gel columns. Mixtures of the unknown product and added carrier acid were co-chromatographed, and identification of the product depended on an exact correspondence between C^{14} activity and acid titer in the elution curves from two or more methods. The identification of several acid products which were isolated in milligram amounts was further confirmed by melting-point determinations. (auth)

1632

ATOMIC EXCITATION IN BETA-DECAY. H. M. Schwartz. J. Chem. Phys. 21, 45-51(1953) Jan.

The excitation and ionization of the daughter atom from a β decay, which is of interest in connection with some hot-atom studies and possibly also in connection with β-recoil experiments, is the subject of an introductory discussion with explicit calculations given only in the case of one-electron hydrogen-like wave function representation of atomic states. The latter correct results in the literature, the only ones so far published on this subject. The present discussion is confined to direct effects of the β-process itself and does not evaluate those resulting from Auger processes. (auth)

1633

RADIATION CHEMISTRY. Discussions Faraday Soc., No. 12(1952). 319p.

A symposium on radiation chemistry held Apr. 8-10, (1952) at Leeds University, England, is reported in full. In addition to publication of the 23 papers presented under the four classifications (1) the primary act of radiation absorption, (2) actinometry and radiolysis of pure liquids, (3) indirect action in aqueous systems with single solutes, and (4) protection and sensitization, which papers are here abstracted separately, 85 pages are devoted to general discussions of these subjects. (G.Y.)

1634
MECHANISM OF RADIOCHEMICAL TRANSFORMATIONS IN AQUEOUS DILUTE SOLUTIONS. M. Haïssinsky. Discussions Faraday Soc., No. 12, 133-43(1952).

Assuming that radiochemical transformations in dilute aqueous solutions are free-radical reactions, it is considered that they are essentially due to the oxygenated radiolytic derivatives of water. Oxidation reactions are preponderant, but even reduction reactions are mostly provoked by OH radicals either directly or indirectly through the reaction $H_2 + OH = H_2O + H$. This conclusion and the high yield of molecular hydrogen obtained during some radiochemical reduction and oxidation reactions justify the hypothesis that H_2 is formed mostly through an elementary process of the type: $H_2O + e$, $H_2 + O^-$. Such a mechanism leads to the formation of two OH radicals and one molecule of H_2 per ion pair. Several somewhat obscure kinetic peculiarities in radiation chemistry are pointed out. (auth)

1635
THE RADIATION CHEMISTRY OF FERROUS-FERRIC SYSTEMS. PART I. REACTIONS IN AIR-EQUILIBRATED SOLUTIONS. C. B. Amphlett. Discussions Faraday Soc., No. 12, 144-55(1952).

The oxidation of ferrous ions by x and γ radiation has been studied in dilute solutions in H_2SO_4 at different acidities. The kinetic scheme proposed to explain the results in 0.8N H_2SO_4 has been found inadequate to explain the variation in initial oxidation yield with pH; it is suggested that the primary act is more complex than is usually assumed. From a study of the steady-state condition at different acidities, values have been obtained for the "equivalent redox potential" of irradiated water with respect to the ferrous-ferric system. The effect of addition of other ions and complexing agents is briefly described. (auth)

1636
THE EFFECT OF THE ENERGY OF THE IONIZING ELECTRON ON THE YIELD IN IRRADIATED AQUEOUS SYSTEMS. T. J. Hardwick. Discussions Faraday Soc., No. 12, 203-11(1952).

A study of the indirect action of x and γ radiation on aqueous ferrous and ceric sulfates shows that the reaction yield varies with the initial energy of the ionizing electrons. This effect can be explained on the basis of existing theories of the primary action of ionizing radiation in water. The interpretation in terms of the theory advanced by Gray permits the calculation of the reaction probabilities of $H + H \rightarrow H_2$ and $HO + OH \rightarrow H_2O_2$ as a function of the instantaneous electron energy. (auth)

1637
SOME ASPECTS OF THE RADIATION CHEMISTRY OF ORGANIC SOLUTES. Gabriel Stein. Discussions Faraday Soc., No. 12, 227-34(1952).

The reactions leading to the eventual formation of free radicals in irradiated aqueous solutions are discussed. It is concluded that, particularly for sparsely ionizing radiations, electron ejection and capture processes are of importance for the understanding of the resultant chemical changes. Reactions of organic substrates, especially some dyes, in aqueous and nonaqueous systems are described, and it is shown that reversible reduction processes occur. Their mechanism is discussed with reference to their possible biological significance. Other reactions of organic substrates, especially simple aromatic substances, are described which prove the formation and the role of the OH radical. The specific functions of molecular oxygen in the radiation chemistry of organic substrates are shown to depend on the nature of the substrate. (auth)

1638
RADIATION CHEMISTRY OF ORGANIC SOLUTIONS. W. Minder and H. Heydrich. Discussions Faraday Soc., No. 12, 305-12(1952).

From halogenated hydrocarbons, irradiated in organic solutions (alcohol, acetone) halogen acids can be extracted with water. The amount of irradiation products rises proportionally to the dose of radiation and is dependent on the concentration of the solution, the number of halogen atoms in the compound, and the type of binding. The yields are about $\frac{1}{3}$ to $\frac{1}{4}$ that found in aqueous solutions, but are not influenced at all by the addition of large amounts of water. The relation between yield and concentration is exponential in form, rising to a saturation value. In compounds containing many halogen atoms, a proportional increase is also found. These results are discussed and compared with theoretical conceptions. (auth)

1639
DISTRIBUTION OF RADIATIVE NEUTRON CAPTURE RECOIL PRODUCTS. A. G. Maddock and N. Sutin. Research (London) 6, suppl., 7S-8S(1953) Jan.

It was suggested from a study of the products of nuclear recoil that when the radiating atom participates in more than one bond in the molecule, products preserving or reforming one or more of these bonds should be found. The products containing 26.8-hr As^{76} were examined after irradiation of pure, crystalline, triphenylarsine in the Harwell pile at a neutron flux of $\sim 10^{10}$ n/cm^2/sec. After irradiation the solid was dissolved in pure, dry, de-aerated benzene. After extensive elution 5 active fractions were separated, namely, triphenylarsine, diphenylarsine oxide, phenylarsine oxide, an unresolved mixture of phenyl and diphenyl arsonic acids, and arsenate. (L.M.T.)

RADIATION EFFECTS

1640
THE RADIOLYSIS OF SOME ORGANIC LIQUIDS. A. Prevot-Bérnas, A. Chapiro, C. Cousin, Y. Landler, and M. Magat. Discussions Faraday Soc., No. 12, 98-109(1952).

A critical review and comparison is made of the possibilities and limitations of two methods which the authors have used for the determination of the number of free radicals formed in organic liquids by ionizing radiations (polymerization initiation and reaction with diphenyl picrylhydrazyl radical). Attempts are made to correlate the sensitivity of different compounds with their chemical structure and to evaluate the G values for the radical formation. This leads to an evaluation of the fraction of energy dissipated which is ultimately used for free-radical production. The mechanism of the production of free radicals in liquids irradiated in a pile is discussed, and a preliminary evaluation of the contributions of different radiations present is given. The possibilities of the determination of the nature of free radicals formed by radiations are briefly indicated, and some preliminary results are given. (auth)

1641
CHEMICAL PHENOMENA IN IRRADIATED PURE WATER. P. Bonet-Maury. Discussions Faraday Soc., No. 12, 72-9 (1952).

Densely ionizing radiations (natural α particles) decompose water, following a simple mechanism in which secondary reactions interfere only to a small extent. The action of sparsely ionizing radiation on water, for example x rays, leads to a very small radiolysis. Dynamic equilibria between the formation and decomposition of products are observed and establish an equilibrium concentration, independent of dose, within certain limits. The heavy accelerated particles behave as if they contained an x-ray and an α-particle component; the radicals of the x-ray component can react with the H_2O_2 or H_2 from the α component and this picture is perhaps applicable to all ionizing particles. For

a linear ion density of the order of 200 ion pairs/μ (corresponding to the equidistance of the radicals H and OH) the yield per particle passes through a maximum and this critical density appears to mark the transition of the α-particle chemistry to the x-ray chemistry. The radiochemical reactions depend without doubt on the initial distribution of ionization in the water, no matter what the ionizing particle is, and this fact plays a major part in the chemistry of radiations. The numerous biological effects depend in the same manner on the ion density and the different biological efficacy of certain radiations can be explained by the difference in the primary chemical effects. (auth)

1642

THE DECOMPOSITION OF HYDROGEN PEROXIDE BY IONIZING RADIATIONS AND RELATED PROBLEMS. Joseph Weiss. Discussions Faraday Soc., No. 12, 161-9 (1952).

The mechanism of the photochemical decomposition of H_2O_2 has been discussed particularly in relation to the decomposition by ionizing radiations. The latter has been treated with reference to the reaction in and between the tracks produced by the fast particles in the solution. Finally, the formation of molecular hydrogen in the irradiation of aqueous H_2O_2 solutions, and in related cases, has been referred to. (auth)

1643

THE FORMATION AND DECOMPOSITION OF H_2O_2 IN AQUEOUS SOLUTIONS BY THE ACTION OF HIGH ENERGY ELECTRONS AND X-RADIATION. M. Ebert and J. W. Boag. Discussions Faraday Soc., No. 12, 189-203(1952).

Experiments are reported on the decomposition of H_2O and H_2O_2 by 1-Mev electrons and by 1.2-Mev and 200-kv x radiation. The dose rate ranged from 300 to 10^7 ergs/g-sec and the radiation dose from about 10^5 up to 10^{10} ergs/g. The decomposition of neutral water showed no dependence on the radiation intensity, but in acidified water the equilibrium concentration of H_2O_2 produced by large doses was dependent on intensity. The experiments reveal a marked difference between 1-Mev electron or x radiation on the one hand and 200-kv or lower energy x radiation on the other. The experimental arrangements and the methods of dosimetry used for the various types of radiation are described. (auth)

1644

THE γ-RAY AND X-RAY INDUCED POLYMERIZATION OF AQUEOUS SOLUTIONS OF ACRYLONITRILE. E. Collinson and F. S. Dainton. Discussions Faraday Soc., No. 12, 212-26 (1952).

Polymerization induced by the action of Ra γ rays, and 220- and 50-kv x rays on aqueous solutions of acrylonitrile has been studied. Radiation dosimetry was by measurement of the oxidation of ferrous ions in all cases. Polymerization in D_2O solution, followed by infrared spectroscopic analysis of the polymers produced gave direct proof of the formation of D atoms in the irradiated liquid, and confirmed their participation in the polymerization. The kinetics of the polymerization were studied over the available concentration range and with dose rates ranging from 6.6×10^{12} to $33,400 \times 10^{12}$ ion pairs/ml-min. At low dose rates the kinetics were consistent with a nonuniform distribution of the radicals formed from the water, while at high dose rates an increasing degree of uniformity was indicated. There was apparently no difference in the effects produced by the three types of radiation. A possible explanation of these results is that all three radiations give rise to randomly distributed volume elements of radicals in water in which chemical reaction takes place, the volume elements being widely separated and independent of each other at low dose rates, but tending to overlap at high dose rates. Though this hypothesis is not finally established, the viscosity molecular weights of the polymers showed a dependence on dose rates which is in general agreement with it. (auth)

1645

PROTECTION EFFECT AND ITS SPECIFICITY IN IRRADIATED AQUEOUS SOLUTIONS. Walter M. Dale. Discussions Faraday Soc., No. 12, 293-9(1952).

Systems which are initially one-solute systems become multi-solute as a result of irradiation. Dissolved oxygen can be a second solute leading to reaction products like HO_2 and H_2O_2 which can cause chemical effects. Radiation effects in two-solute systems have been investigated on two different, but complementary, lines. First, the estimation of gaseous end-products, and secondly the estimation of a change of the initial solute. A second solute in a two-solute system acts as a competitive acceptor of free radicals thus reducing the radiation effect on the first solute, i.e., protecting it. This protective effect can be used as a measure of the protective power of various solutes relative to the first solute (the indicator). The specificity of this effect, in particular that of sulfur, is demonstrated in experiments with the enzyme carboxypeptidase and with alloxazin-adenine dinucleotide as the indicators. The protective power per unit mass of protector is sometimes dependent on the concentration of the protector. It has to be assumed in such cases that protector molecules can hand on energy to the indicator. (auth)

1646

EFFECTS OF RADIATIONS ON AQUEOUS SOLUTIONS OF INDOLE. C. B. Allsopp and J. Wilson. Discussions Faraday Soc., No. 12, 299-305(1952).

As estimated with Ehrlich's reagent, indole appears to be readily decomposed by small doses of x radiation (i.e., up to 20 r). The quantity decomposed increases with increasing concentration of indole and decreasing dosage rate. The initial decomposition is rather greater in solutions prepared and irradiated in an atmosphere of nitrogen than in aerated solutions; the subsequent reaction appears to be quantitatively the same. The radiation-chemical and photo-chemical decompositions of indole (in presence of air) follow similar courses. These effects are considered to be consistent with an initial oxidation to indole-5,6-quinone followed by oxidative condensation of this substance with unchanged indole. (auth)

SEPARATION PROCEDURES

1647

Wisconsin Univ. Coll. of Agriculture

SIMULTANEOUS SEPARATION OF PURINES, PYRIMIDINES, AMINO ACIDS AND OTHER NITROGENOUS COMPOUNDS BY ION EXCHANGE CHROMATOGRAPHY, by Joseph S. Wall. [nd] 18p. (AECU-2349)

Mixtures of purines, pyrimidines, amino acids and other nitrogenous compounds of biological origin were simultaneously separated by chromatography on a single column of the cation exchange resin, Dowex-50, in the acid form. The compounds were eluted from the resin with HCl and detected and quantitatively determined by their reaction with ninhydrin reagent or their ultraviolet absorption. The method has been applied to the separation and analysis of the nitrogenous components of hydrolysates of bacterial cells. By means of this procedure approximately 97% of the nitrogen of the hydrolysates was accounted for in 25 known compounds. (auth)

1648

Utah Univ. Coll. of Mines and Mineral Industries

TECHNICAL REPORT NO. VIII [ON] A THEORY OF CATION EXCHANGE REACTIONS WITH CLAY MINERALS, by Ivan B. Cutler and Melvin A. Cook. May 1, 1952. 28p. (AECU-2382; Tech. Report No. 8)

An investigation was made of cation exchange reactions with clay minerals. Equilibrium expressions based on the shift-of-coordination concept and on the weak-acid concept are presented for monovalent cation exchange only. To test the validity of the combined equilibria postulated, experi-

mental data previously reported by Marshall et al. (J. Phys. Chem. 46, 52, 327, 1072(1942)) describing the titration of electrodialyzed clays were analyzed. The clay minerals used in the study were kaolinite, montmorillonite (bentonite), beidellite, and illite. The bases were NaOH, KOH, and NH_4OH. Marshall's data were used for determination of pH's, concentration of clay mineral, amount of base added, and the activity of the cation common to the titrating base, as determined by means of a clay-membrane electrode. An analysis of Marshall's experimental data by means of the equilibrium theory led to the conclusions that at least three equilibrium reactions are involved in base exchanges, all of which must be given consideration in order to explain quantitatively the observed phenomena. These are discussed in detail. (C.R.)

1649

Oak Ridge National Lab.

A STUDY OF THE ELECTRODEPOSITION OF RUTHENIUM FROM VERY DILUTE SOLUTIONS, by M. H. Lietzke and J. C. Griess, Jr. Issued Feb. 2, 1953. 30p. (ORNL-1399)

The deposition behavior of Ru at low concentrations has been investigated under a variety of conditions. Only when the Ru was in solution as the Ru nitroso complex were reproducible results obtained. Complete deposition was not possible at concentrations below 10^{-5} molar. A mechanism involving a catalytic hydrogen reduction of the Ru nitroso complex is proposed to account for the complete deposition of macro amounts of Ru and the incomplete deposition of micro amounts. (auth)

SPECTROSCOPY

1650

Brookhaven National Lab.

MASS SPECTRA OF SIX LACTONES, by Lewis Friedman and F. A. Long. Brookhaven National Lab. and Cornell Univ. [nd] 17p. (BNL-1334)

Mass spectra are given for the aliphatic lactones, β-propio, γ-butyro, γ-valero, γ-crotono, β-angelica and α-angelica. For three of the lactones spectra were also obtained of samples with carbonyl oxygens containing enriched O^{18}. A detailed discussion of the data is given and it is concluded that the main peaks of the spectra result from splitting of two alternate bonds of the lactone rings. The stability of the parent molecule ions is greater with the unsaturated lactones and their spectra are characterized by larger intensity of peaks due to rearrangement. Although there are frequent large variations in yields of particular ions, the spectra for both the saturated and the unsaturated lactones arise from similar bond-splitting processes. (auth)

1651

Brookhaven National Lab.

MASS SPECTRA AND APPEARANCE POTENTIALS OF KETENE MONOMER AND DIMER; RELATION TO STRUCTURE OF DIMER, by F. A. Long and Lewis Friedman. Brookhaven National Lab. and Cornell Univ. [nd] 15p. (BNL-1335)

Mass spectra are given for ketene dimer. The spectrum of the latter indicates that in the vapor phase the structure is vinylaceto-β-lactone, the same as shown by the solid at low temperatures. Appearance potentials are given for the prominent ions from both species. The low value of the appearance potential of CH_2^+ from ketene, 13.8 volts, can be explained by postulating that an energy-coupling mechanism is involved in the formation of this ion. (auth)

1652

Mallinckrodt Chemical Lab., Harvard Univ.

THE MICROWAVE SPECTRUM AND STRUCTURE OF CHLOROFLUOROMETHANE, by Norbert Muller. [nd] 18p. (NP-4267)

The microwave spectra of $CH_2Cl^{35}F$ and $CH_2Cl^{37}F$ between 16,100 and 39,000 Mc have been measured and analyzed. The rotational parameters are $\underline{a}$ = 41,810.1 Mc; $\underline{b}$ = 5,715.7 Mc; $\underline{c}$ = 5,194.6 Mc; and $\underline{a}$ = 41,738.2 Mc; $\underline{b}$ = 5,580.5 Mc; $\underline{c}$ = 5,081.6 Mc; respectively. The structural parameters, calculated with an assumed value of 111°56′ for the H-C-H angle, are r_{CH} = 1.078 ± 0.005 A; r_{CCl} = 1.759 ± 0.005 A; r_{CF} = 1.378 ± 0.006 A; Cl-C-F = 110°1′ ± 2′; θ = 125°41′ ± 5′, where θ is the angle between the C-Cl bond and the projection of the C-H bonds on the symmetry plane. From the hyperfine structure of the $1_{0,1}$-$1_{1,0}$ transition, the quadrupole coupling constants were evaluated as χ_a = −52.18 ± 1 Mc, χ_b = 38.83 ± 1 Mc. With certain assumptions, this leads to a value of 6.6% for the percent double-bond character of the C-Cl bond. (auth)

1653

NEW MEASUREMENTS OF THE SPECTRAL INTERVALS SEPARATING THE HYPERFINE COMPONENTS OF THE MERCURY LINE λ 2537. Robert Lennuier and Jean-Louis Cojan. Compt. rend. 235, 1634-6(1952) Dec. 22. (In French)

The structure of the 2537 A line of Hg has been determined by an interferometric study. The hyperfine components have been correlated with isotopic composition. (G.Y.)

1654

SERIES AND IONIZATION POTENTIALS IN THE I AND II SPECTRA OF ELEMENTS OF THE PALLADIUM GROUP. M. A. Catalán and F. R. Rico. Anales real soc. españ. fís. y quím. A48, 328-38(1952) Nov.-Dec. (In Spanish)

The structural data known at present for the configurations $4d^{n-1}$ 5s and $4d^{n-1}$ 6s in the Rb I, Sr I, Pd I, Ag I, Sr II, and Cd II spectra suggest the possibility of extending the relations recently found by Catalán and Velasco for the Fe group to the Pd group. Following the analogy, and using the existing experimental data, curves have been drawn for the distances between terms 6s and 5s, Rydberg denominators, α values of the Ritz constant, and separations between Rydberg denominators, for high and low multiplicity, in 5s and 6s. The values of the limits of the series were adjusted in order that all the curves run smoothly. Only a few points fall outside these curves, showing that the corresponding terms are probably perturbed by interactions. From the adjusted limits, values of the ionization potentials for Rb I, Cd II, and Sr, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, and Ag I and II were deduced. (auth)

SYNTHESES

1655

Argonne National Lab.

THE NORMAL CONTENT OF FIXED CARBON IN AMINO ACIDS, by Robert W. Swick, Donald L. Buchanan, and Akira Nakao. Dec. 1952. 13p. (AECU-2374; UAC-675)

Rats were exposed to an atmosphere constantly labeled with $C^{14}O_2$ until the liver and muscle carbon approached isotopic saturation. The distribution of fixed carbon in the amino acids of these tissues was then examined. The guanidino group of liver arginine was nearly all derived from CO_2. About 25% of the two carboxyl groups of aspartic acid and of the α-carboxyl group of glutamic acid contained fixed carbon. Less was present in the carboxyl groups of alanine, serine, and glycine. Of the amino acids examined, only liver alanine, aspartic and glutamic acids, and the guanidino group of liver arginine contained more fixed carbon than their counterparts from muscle. There was little CO_2-derived carbon in the β-C of serine and almost no fixed carbon in the essential amino acids and tyrosine. (auth)

1656

Radiation Lab., Univ. of Calif., Berkeley

NOTES ON THE PREPARATION OF HYDROGEN CYANIDE-

C^{14} FROM $BaC^{14}O_3$. II., by R. M. Lemmon. Nov. 21, 1952. 4p. (UCRL-2026)

An earlier report (UCRL-1299) describes the preparation of hydrogen cyanide-C^{14} from barium carbonate-C^{14} by the reduction of CO_2 in a bomb tube in the presence of potassium and ammonia. Since that time it has been found more convenient to use the method of McCarter (J. Am. Chem. Soc. 73, 483(1951)) to obtain the labeled cyanide. By using a modification of this method, it has been found possible to carry out the reaction on a 5-millimole scale and to obtain yields of 87-93%. Five millimoles of C^{14}-labeled potassium carbonate was prepared from the same amount of Oak Ridge barium carbonate by absorption of the $C^{14}O_2$ in 2 cc of a 5.5N potassium hydroxide solution, followed by freezing the solution and evaporating it to dryness under high vacuum. The powdered carbonate was thoroughly mixed with 5 g of zinc dust and placed in a Coor's size 6A porcelain boat which was then inserted into a 700 × 15 mm quartz tube and placed next to a loose ball of iron wire in the middle of the tube. Anhydrous ammonia was allowed to flow through the tube so that it passed first over the wire and then over the boat. From the far end of the quartz tube an attached glass tube led under the surface of a normal NaOH solution which served to trap any cyanide and to indicate the speed of passage of the ammonia. The quartz tube was then heated by an electric furnace to a temperature of 650° (measured inside the quartz tube by a thermocouple). The tube was maintained at this temperature under a constant stream of ammonia (about 3 to 4 bubbles per sec) for 10 to 12 hr. After the quartz tube had cooled, the porcelain boat was transferred to a two-necked round bottom flask used to generate the hydrogen cyanide. The hydroxide solution which was at the end of the quartz tube, as well as washings from the tube itself, were added to the flask. The flask was connected to a dropping funnel and, through a Liebig condenser, to a gas-washing bottle filled with normal NaOH solution. Excess dilute sulfuric acid was slowly added to the flask from the funnel, and the contents of the flask were boiled for about 10 minutes to insure the evolution of all hydrogen cyanide. The yields of cyanide were determined (per Carter) by titrating a small aliquot portion with standard silver nitrate solution in the presence of iodide ion and a small excess of ammonia and from the specific activity of the labeled cyanide obtained after evaporating the cyanide solution to dryness. The values for the yields were always within 2% of agreement. (Entire report)

WASTE DISPOSAL

1657

Mound Lab.

SAMPLES OF SOIL FROM ARCO, IDAHO (Information Report), by G. D. Stewart. Nov. 22, 1949. Decl. Jan. 27, 1953. 7p. (AECD-3487; MLM-401)

Soil samples from a single drilling made at Arco, Idaho, were tested for the adsorptive capacity of the soil for radioactive elements. Weighed and powdered soil samples were shaken for 1 hr with measured amounts of reactor waste solution containing radioactive Cs, Ru, Te, and Sb. The mixture was then centrifuged, and the radioactivities of aliquot samples were counted with a G-M tube. Data are tabulated for the type of soil, the per cent of activity removed for each stratum, and the depth of each stratum. (C.R.)

ENGINEERING

1658

Argonne National Lab.

ANTI-SWING CRANE WITH ANTI-CREEP VARIABLE SPEED HOISTING, by Raymond C. Goertz. Oct. 1952. 12p. (ANL-4962)

Description is given of a laboratory model of a remotely controlled anti-swing crane with anti-creep variable-speed hoisting, such a crane being desirable for handling radioactively hot or thermally hot materials. (L.M.T.)

HEAT TRANSFER AND FLUID FLOW

1659

California Univ., Berkeley

AN INVESTIGATION OF AIRCRAFT HEATERS. XXXIV. EXPERIMENTAL DETERMINATION OF THERMAL AND HYDRODYNAMICAL BEHAVIOR OF AIR FLOWING BETWEEN A FLAT AND A WAVE-SHAPED PLATE, by L. M. K. Boelter, V. D. Sanders, G. Young, M. Morgan, and E. H. Morrin. Aug. 1951. 30p. (NACA-TN-2426)

Investigation was conducted on thermal and hydrodynamical behavior of air flowing along a passage of which one side was flat and steam-heated and the other side was wave-shaped and unheated. Turbulence produced by air flowing over wavy surfaces approximately doubles heat-transfer rate for narrow duct widths. At large duct widths, the effect is negligible. Pressure drop was greatly increased over that for a straight duct. Pressure drop was increased to at least 4 times for large duct widths and to at least 10 times for small duct widths. (NACA)

1660

Massachusetts Inst. of Tech.

VISUAL STUDY OF WATER FLOWING OVER A FLAT PLATE AT HIGH RATES OF HEAT TRANSFER WITH SURFACE BOILING, by Robert W. Jeffery. Nov. 1, 1952. 64p. (NP-4348)

The procedure for investigating the mechanism of heat transfer to water undergoing surface boiling consisted of fixing the system pressure, inlet temperature, and velocity and then photographing the resulting bubble pattern caused by electrically heating a flat plate of stainless steel. The distilled, degassed water flowed upward in the test section and was kept chemically pure by an ion exchanger. (J.E.D.)

1661

TRANSMISSION OF SHOCK WAVES IN THINWALLED CYLINDRICAL TUBES. Frithiof I. N. Niordson. Acta Polytech. Phys. Appl. Math. 2, No. 1(1952) 24p.

The ordinary jump conditions of a shock front are modified so as to take into account the consumption of energy in the walls of the cylindrical tube in which the shock wave is transmitted. It is found that a shock wave cannot travel above and arbitrarily close to a certain critical velocity where the deformation of the tube becomes considerable. A shock wave moving in a rigid tube and entering a thin-walled tube of the same inner diameter is retarded while the particles are accelerated and the pressure behind the front decreases. (auth)

1662

EXISTENCE OF PLANE, PERMANENT, IRROTATIONAL, UNIFORM-AT-INFINITY FLOWS OF INCOMPRESSIBLE LIQUIDS. Robert Gerber. Compt. rend. 235, 1601-2(1952) Dec. 22. (In French)

Certain solutions of the mathematical problem are found to exist. (G.Y.)

MATERIALS TESTING

1663

Knolls Atomic Power Lab.

STRESSES AND DEFORMATIONS OF FLANGED SHELLS, by G. Horvay and I. M. Clausen. [nd] 33p. (AECU-2375)

The formulas for the internal reactions that must be developed at the common edge of shell and flange if the rotational and translational misalignments are to be eliminated are derived. The formulas which relate shell

and flange deformation and stress to applied moment and force are listed. The method is illustrated by an example which involves weight, pressure, and temperature loadings. In the appendix the formulas which relate flange and shell deformations to axial temperature variations are listed. (L.T.W.)

PUMPS

1664
Oak Ridge National Lab.
AN IMPROVED AC ELECTROMAGNETIC PUMP CELL, by M. E. LaVerne. Dec. 7, 1952. 15p. (CF-52-12-153)

A discussion of the design modifications and performance of an a-c electromagnetic pump is reported. (J.E.D.)

VACUUM SYSTEMS

1665
PROGRESS IN HIGH VACUUM TECHNIQUE. J. Kistemaker. Nederland. Tijdschr. Natuurk. 18, 259-63(1952) Oct. (In Dutch)

Recent published developments in vacuum pumps, high-vacuum apparatus construction techniques, valves, controlled leaks, manometers, etc., are described briefly. 7 references. (G.Y.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1666
Battelle Memorial Inst.
EFFECT OF SHAPE AND MATERIAL ON THE THERMAL RUPTURE OF CERAMICS, by E. M. Baroody, W. H. Duckworth, E. M. Simone, and H. Z. Schofield. May 22, 1951. Decl. Jan. 21, 1953. 75p. (AECD-3486; BMI-70)

A preliminary investigation on the effect of shape and material on the thermal rupture of certain ceramics which appear to have promise as fuel-element materials, moderators or structural members for high temperature nuclear reactors is reported. The study deals primarily with thermal rupture caused by steady-state radial heat flow through a circular tube. Detailed equations for only the specialized cases of very short and of very long, round tubes are presented, and these are subject to certain restricted boundary conditions and assumptions. (J.E.D.)

1667
National Bureau of Standards
INVESTIGATION OF GASES EVOLVED DURING FIRING OF VITREOUS COATINGS ON STEEL, by Dwight G. Moore and Mary A. Mason. Jan. 1953. 34p. (NACA-TN-2865)

A study was made of the nature and source of gases evolved when a ground-coat enamel is applied to low-carbon steel. The principal gases evolved were found to be CO, CO_2, and H_2. The cause of primary boil was determined as the evolution of carbon gases from the oxidation of carbon in the steel. Further results indicate that H_2, formed from the reaction between dissolved H_2O in the coating and the hot iron base, diffuses into the coating as firing continues. On fast cooling the H_2 is expelled causing bubbles to form at the interface of the coating. Practically all the bubble structure in a normally fired enamel was found to be due to some impurity in the clay addition which may be organic matter adsorbed on the clay particles. (NACA abst.)

1668
Fansteel Metallurgical Corp.
INTERIM REPORT [ON] STUDY AND RESEARCH OF THE SILICONIZING OF TITANIUM FOR PERIOD JULY 1, 1952 THROUGH DECEMBER 31, 1952, by Stanley Kluz, Caesar Kalinowski, and Ralph Wehrmann. [Jan. 26, 1953.] 27p. (NP-4347; 401/51-18)

Si coatings afforded protection to Ti for 1500 hr at 800°C in air were prepared by the paint and sinter method. Helium or vacuum appear to be superior to H_2 for sintering purposes. A brief investigation of the vapor-phase method of coating Ti with Si using $SiCl_4$ and H_2 was not successful. Packing Ti strips in Si powder containing I and KI and heating produced poor quality coatings. Bodies of Ti_5Si_3 were prepared by powder metallurgy. A density of 3.9 g/cm³ (90% theoretical), modulus of rupture 30,000 psi, and 79 Rockwell A hardness were obtained. (L.T.W.)

1669
Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES: SURFACE TENSION AT ELEVATED TEMPERATURES, I. FURNACE AND METHOD FOR USE OF THE SESSILE DROP METHOD; SURFACE TENSION OF SILICON, IRON, AND NICKEL, by W. D. Kingery and M. Humenik, Jr. Feb. 1, 1953. (NYO-3143)

Difficulties in the experimental determination of surface tension at elevated temperatures have been overcome by use of the sessile drop method with precise methods of measurement. A description of the sessile drop method of surface tension determination is included with a description of an induction furnace suitable for determining the shape of sessile drops in vacuo or in pure atmospheres up to temperatures of at least 2000°C. Methods of obtaining precise measurements capable of yielding surface tensions within ±2 to 3% are described. Calculations of the surface tension of water and molten silver by the sessile drop method gave values in good agreement with determinations by other methods. Surface tensions of liquid Si, Fe, and Ni have been measured. (auth)

1670
STRUCTURE AND PROPERTIES OF $MgO-ZrO_2-SiO_2$ SYSTEM. A. S. Berezhnoĭ and L. I. Karyakin. Ogneupory, 211-21(1952) May. (In Russian)

A systematic investigation of solid-phase reactions in the $MgO-ZrO_2-SiO_2$ system and of sintering capacity of materials within this system is presented.

CORROSION

1671
Oregon Univ.
PROGRESS REPORT ON ELECTROCHEMICAL AND POLAROGRAPHIC STUDIES ON THE CORROSION OF ZIRCONIUM IN PRESENCE OF VARIOUS AQUEOUS MEDIA, by Pierre Van Rysselberghe. Jan. 23, 1953. 3p. (AECU-2385)

No detectable O_2 consumption was observed in contact between Zr and air-saturated aqueous solutions of 2M to 7M HCl. Surface changes during Zr corrosion were studied by observing the time rate of change of potential of a Zr surface dipped in various aqueous media. The potential vs. time curves showed the potential rapidly rising towards more positive values and leveling off to a slowly increasing value. In presence of N_2, with small amounts of O_2 present, the curves level off at lower potentials than with air-saturated solutions. Polarization curves of Zr in 1N Na_2SO_4 show that the anode remains highly polarized to potentials as high as 18 v. In distilled H_2O the anode remains polarized until O_2 evolution begins at about 0.8 v vs. the standard H_2 electrode. In 1.07N HCl and 1N KCl the anode depolarizes completely at 0.40 v vs. H_2, and pitting of the electrode is observed. In 1N KCl and 1N Na_2SO_4, air-saturated, the cathodic polarization curve has two steps corresponding to the reduction of O_2 and to that of H^+. $FeCl_3$ shifts the curve towards more positive potentials. (L.T.W.)

GEOLOGY AND MINERALOGY

1672

Commissariat à l'Énergie Atomique (France)

UNE NOUVELLE ESPÈCE URANIFÈRE FRANÇAISE: LA RENARDITE. (A NEW FRENCH URANIFEROUS SPECIES: RENARDITE), by G. Branche, J. Chervet, and C. Guillemin. Dec. 1949. 7p. (CEA-30)

Renardite, previously reported only from Kasolo and Shinkolobwe, Belgian Congo, has been discovered at Grury, France. Several modes of occurrence and crystallographic distinctions are described. (G.Y.)

1673

Commissariat à l'Énergie Atomique (France)

UNE NOUVELLE ESPÈCE URANIFÈRE FRANÇAISE: LA PARSONSITE. (A NEW FRENCH URANIFEROUS SPECIES: PARSONSITE), by G. Branche, J. Chervet, and C. Guillemin. Dec. 1949. 13p. (CEA-34)

Mode of occurrence, optical properties, crystallography, and chemical analysis of parsonsite found at Lachaux and Grury, France are described. The chemical analysis scheme is given in detail. (G.Y.)

1674

ISOTOPIC COMPOSITION OF OXYGEN IN MINERALS OF SKARN ORIGIN. A. P. Vinogradov and E. I. Dontsova. Doklady Akad. Nauk. S.S.S.R. 85, 1341-3(1952) Aug. 21. (In Russian)

Oxygen isotopic-ratio changes in magnetite of skarn genesis are found to be the result of reactions of $CaCO_3$ with volatile Fe compounds, such as chlorides. (G.Y.)

1675

PRELIMINARY RESULTS ON MEASUREMENTS OF AGE OF SKINKOLOBWE PITCHBLENDE BY THE RaD METHOD. F. Begemann, H. von Buttlar, F. G. Houtermans, N. Isaac, and E. Picciotto. Bull. soc. belge géol. paléontol. et hydrol. 61, 223-6(1952) Oct. 15. (In French)

Determination of the Pb/U ratio from measurements of the ratio of RaD (Pb^{210}) to Pb has the advantages that only one chemical determination, that of Pb, need be made and that the ratio, since the two substances are isotopic, does not change during the chemical reactions. Ages of two Shinkolobwe, Belgian Congo pitchblende ores determined by this method are $614.5 \pm 18 \times 10^6$ and $680.1 \pm 20 \times 10^6$ yr. (G.Y.)

1676

DISTRIBUTION OF RADIOACTIVITY IN ERUPTIVE ROCKS. VI. GRANITE OF KASAI, BELGIAN CONGO. E. E. Picciotto. Bull. soc. belge géol. paléontol. et hydrol. 61, 215-20(1952) Oct. 15. (In French)

A Kasai granite thought by Ledoux (Ann. soc. géol. Belge 177, 210(1914)) to contain four Th or U minerals was examined with a nuclear-emulsion technique. Because of their low α activity, none of the four inclusions can be minerals of Th or U. The Kasai samples are less radioactive than normal graphite, containing only $\sim 10^{-6}$ (g of U)/g and $\sim 3 \times 10^{-6}$ (g of Th)/g. (G.Y.)

1677

RADIOACTIVITY OF BELGIAN CLAYS. I. de Magnee. Bull. soc. belge géol. paléontol. et hydrol. 61, 165-75(1952) Oct. 15. (In French)

The γ activities of a series of Belgian clays, both continental and marine, have been measured with a G-M counter and correlated with chemical composition and particle-size distribution. The measured activities ranged from 2.2×10^{-12} to 8.8×10^{-12} (g of Ra)/(g of clay). (G.Y.)

1678

RADIOACTIVITY OF MT. ETNA LAVAS. S. Milone Tamburino and A. Stella. Nuovo cimento (9) 9, 1044-53(1952) Nov. (In Italian)

Using nuclear emulsions and the techniques of thin sections and of layers of powdered and pressed rocks the radioactivity of several Etnean lavas has been investigated. It has been found that the radioactivity changes by a factor 1.5 for lavas emitted in various phases of the same stream and by a factor 1.75 for lavas of different streams, also if they took place thousands of years apart. It is concluded therefore that the radioactivity of Etnean lavas does not depend substantially on the age of the stream. It has been further found that the radioactive elements are detected in the fundamental mass and are never included in the phenocrystals. The radioactivity of the fundamental mass of the various streams has been measured, and a maximum change by a factor 1.51 has been found between lavas of different streams. The average value of the radioactivity of the fundamental mass is twice the average value of the radioactivity of the corresponding lava. It has been tried to identify to which constituents of the fundamental mass the radioactivity pertains; it seems that at least part of the radioactive elements are associated with apatite. (auth)

METALS AND METALLURGY

1679

Illinois Univ.

ISOTHERMAL ANNEALING EFFECTS IN IRRADIATED COPPER, by Albert W. Overhauser. Nov. 1952. 34p. (AECU-2358)

Copper wires were bombarded with 12-Mev deuterons at low temperatures. The wires were then allowed to anneal isothermally at successive temperatures from –185 to +167°C. Recovery of the electrical resistivity increase, produced by the bombardment, was observed at all temperatures. The annealing curves obtained for temperatures between –185 and –60°C were of such a character that only a number of processes with different activation energies could account for them. One-half of the resistivity increase recovered in this range. The activation energies obtained were observed to be proportional to the absolute temperature. A value of 0.44 ev was found near –100°C. Above –60°C the annealing behaved as though it were a single process with a unique activation energy. This process accounted for 25% of the increased resistivity and had an energy of 0.68 ev. At room temperature 25% of the increase remained, and further anneals to temperatures as high as 167°C produced only an additional 4% recovery. Detailed analysis of the data indicated that the single process occurring above –60°C is due to the annihilation of interstitial atoms and vacancies that are produced by the irradiation. Slight deviations of the recovery rate from that expected of such a second order process were observed and could be explained as the effect of elastic strains introduced into the lattice by interstitial atoms. The effect of such lattice strains on the rate of vacancy migration was calculated and found to have sufficient magnitude to explain the data. The results also suggested that the low temperature recovery is due to the correlated annihilation of very close interstitial vacancy pairs, the low activation energies being due to large elastic strains in the immediate vicinity of an interstitial. A further result was that Mathiessen's rule was found to be valid for the resistance due to radiation damage. (auth)

1680

Armour Research Foundation

STRUCTURAL CHANGES OF COMMERCIAL TITANIUM AND TITANIUM-BASE ALLOYS ON HEAT TREATMENT, by William Rostoker and Max Hansen. Nov. 1951. 59p. (AF-TR-6686; ATI-159575)

The solid state transformation characteristics for a number of Ti-base alloy systems have been studied with a view to recognizing the types of transformations and the effect of the phase relationships on the reaction kinetics.

Both conventional nucleation and growth and martensitic transformations have been demonstrated. It has been found possible to represent graphically the reaction kinetics by means of conventional TTT charts. A cursory study of hardness trends also has been carried out. The report summarizes investigations carried out over the period Oct. 25, 1950 to Oct. 25, 1951. (auth)

1681
Carnegie Inst. of Tech.
FINAL REPORT [ON] RESEARCH AND DEVELOPMENT OF EFFECT OF RANGE OF STRESS AND PRESTRAIN ON THE FATIGUE PROPERTIES OF TITANIUM AND ITS ALLOYS, by J. P. Romualdi and E. D'Appolonia. Oct. 1952. 82p. (NP-4254; WAL-401/68-15)

The effects of range of stress and prestrain on the fatigue properties of Ti alloy, cold drawn and annealed (equal to RC-55), were studied on rotating beam machines which permit a full range of loading from pure bending to pure tension in any combination. Complete reversal tests were also conducted on type TI-75A Ti alloy. The data are analyzed to show the effect of hardness and heat number (different chemical composition) on the fatigue properties. The effects of rate of strain and internal heating were determined by conducting tests at low speed and under isothermal conditions. The fatigue properties of these alloys are appreciably influenced by the rate of strain and the heat generated during the test. Mechanical tests were conducted on the Ti alloys and correlations between mechanical properties and fatigue properties are reported. Design curves summarize the data in convenient form for use in design. (auth)

1682
Carnegie Inst. of Tech.
INTERIM TECHNICAL REPORT NO. 2 ON GALLING AND SEIZING CHARACTERISTICS OF TITANIUM AND TITANIUM-BASE ALLOYS [FOR] APRIL 15, 1952–OCTOBER 15, 1952, by William C. Leone. [nd] 22p. (NP-4256; Interim Technical Report No. 2; WAL-401/65-13)

A study is made of the galling and seizing characteristics of Ti and Ti alloys. Equipment for doing the experimental work on friction characteristics for various loads and speeds is described. Typical results of tests made to date are presented. The effects on galling of load, speed, roughness, and time of rubbing are discussed. (J.E.D.)

1683
Battelle Memorial Inst.
SECOND INTERIM TECHNICAL REPORT ON CHEMICAL SURFACE TREATMENT OF TITANIUM [FOR FEBRUARY 1, 1952 TO OCTOBER 31, 1952] TO WATERTOWN ARSENAL, by H. A. Pray, Paul D. Miller, Richard A. Jefferys, and R. L. Gibbs. Oct. 31, 1952. 52p. (NP-4260; WAL-401/45-18; Interim Technical Report No. 2)

From studies of a large number of coating baths, both chemical and electrochemical, for surface coatings on Ti and its alloys, it was concluded that a few compositions will satisfactorily coat Ti. Results obtained from experimental and test data show that three types of baths produce coatings which will allow wire drawing and will stand high-pressure wear tests. They are the NaOH anodic-type bath, the phosphate immersion, and the oxalate immersion-type baths. Test data are presented in tabular form and the merits and demerits of these coatings are discussed. (C.R.)

1684
Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 14, SCOPE II, by B. L. Averbach, M. Cohen, P. S. Rudman, E. E. Underwood, W. F. Flanagan, and J. Hilliard. Dec. 31, 1952. 3p. (NYO-3811; Tech. Progress Report 14)

Progress is briefly reported on thermodynamics of solid Al-Zn and Al-Ag alloys and x-ray studies of atomic arrangements in the Al-Zn system. (See NYO-3809 for preceding report) (L.T.W.)

1685
Massachusetts Inst. of Tech.
FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION; TECHNICAL PROGRESS REPORT NO. 9, SCOPE III, by B. L. Averbach, M. Cohen, S. Allen, and P. Fopiano. Dec. 31, 1952. 3p. (NYO-3812; Tech. Progress Report 9)

Progress is briefly reported on deformation of Cu-alloy single crystals and deformation of Al single crystals. (See NYO-3810 for preceding report) (L.T.W.)

1686
Tennessee Univ.
CALORIMETRIC STUDIES OF PLASTIC DEFORMATION AND PHASE TRANSFORMATIONS FOR PERIOD ENDING DECEMBER 1, 1952, by E. E. Stansbury, G. E. Elder, and M. L. Picklesimer. [nd] 6p. (ORO-86)

Preliminary investigations are reported of the magnitude of the increase in internal energy resulting from cold working in Ag-bearing Cu and measurements of the specific heats and heats of transformation in high-purity unalloyed and alloyed eutectoid Fe-C alloys. (C.R.)

1687
General Electric Research Lab.
THERMODYNAMICS OF ORDERING ALLOYS: I. ACTIVITIES IN COBALT-PLATINUM ALLOYS, AND SOME GENERAL CONSIDERATIONS ON ORDERING SYSTEMS, by R. A. Oriani. Dec. 1952. 24p. (SO-2025; RL-777)

The activity of cobalt in solid Co-Pt alloys has been measured by the galvanic-cell technique. The observed thermodynamic properties are not those predicted by the quasi-chemical theory for ordering alloys. The properties of this and other ordering systems are discussed from the point of view of distortional energy, thermal entropy, and electronic interactions. It is shown that in general the distortional or strain energy cannot be evaluated from a comparison of the heats of solution of corresponding solid and liquid solutions. (auth)

1688
SELF-DIFFUSION IN THE ALKALI METALS. D. K. C. MacDonald. J. Chem. Phys. 21, 177-8(1953) Jan.

The following activation energies for self-diffusion in the solid alkali metals have been determined from the "excess" electrical resistance (an exponential rise in resistance starting well below the melting point) and an assumption of an equilibrium number of lattice vacancies: Li, 9.3 ± 0.35; Na, 9.1 ± 0.1; K, 9.1 ± 0.1 kcal/mole. The figures for Li and Na are in good agreement with those of Gutowsky and McGarvey (NSA 6-6445). The constancy of the three values is remarkable in view of the variation in latent heat of vaporization: Li, 32.6; Na, 23; K, 19.3 kcal/mole. No exponential resistance rise was observed in Rb and Cs, in accord with their lower melting points. (G.Y.)

PHYSICS

1689
Purdue Univ.
PROGRESS REPORT NO. II [ON] RESEARCH IN NUCLEAR PHYSICS. June 15, 1952. 35p. (AECU-2331)

Progress is reported on the following studies: the (α,n) and $(\alpha,2n)$ cross sections of Ag^{109}, α-particle excitation of Rh^{103}, the reaction $S^{32}(d,2p)P^{32}$, influence of the chemical state on the γ-ray angular correlations of Cd^{111}, γ-γ angular

correlation in Cd^{114}, γ angular correlation of Pd^{106}, γ angular correlation of Pt^{194}, decay of Ir^{194}, high-energy β transition of A^{41}, Si^{31} gamma emission, internal conversion of the V^{48} γ rays, scintillation response of anthracene to heavy recoil ions, ghost lines in the lens spectrometer, and efficiency of brass cathode counters for γ rays of 0.2 to 2.8 Mev. (See AECU-2339 for previous report.) (L.T.W.)

1690

Purdue Univ.

PROGRESS REPORT NO. I [ON] RESEARCH IN NUCLEAR PHYSICS. June 15, 1951. 40p. (AECU-2339)

Progress is reported on the following studies: the isomers of In^{110} and In^{112}, deuteron and α-particle range-energy relations for nuclear track plates, angular momenta of the excited states of Pt^{196}, dual decay of the 50-day In^{114} isomer and angular momenta of the excited states of Cd^{114}, memory in angular correlation of γ rays from the excited states of Cd^{111}, fast delayed coincidence circuit for scintillation counters, disintegration scheme of Re^{186}, β and γ spectra of Re^{186}, and high-energy positrons from V^{48}. (L.T.W.)

1691

Laboratory for Nuclear Science, Mass. Inst. of Tech.

CHEMISTRY OF THE FISSION ELEMENTS GROUP and COSMIC RAY GROUP and ELEMENTARY PARTICLE SCATTERING GROUP, p.1-14 of TWENTY-SEVENTH PROGRESS REPORT FOR PERIOD AUGUST 31, 1952 TO NOVEMBER 30, 1952. Nov. 30, 1952. 14p. (AECU-2347(p.1-14))

Progress is briefly reported on the following studies: Ce complexes in carbonate media, applications of the stationary Hg electrode, decay of V particles, east-west effect of positive and negative mesons near the equator, atmospheric effects on cosmic-ray intensity at sea level, photomeson production cross sections of H, and photonuclear experiments with the linear accelerator and the synchrotron. (L.T.W.)

1692

Laboratory for Nuclear Science, Mass. Inst. of Tech.

ONR GENERATOR GROUP and RADIOACTIVITY AND CYCLOTRON GROUP, p.30-46 of TWENTY-SEVENTH PROGRESS REPORT FOR PERIOD AUGUST 31, 1952 TO NOVEMBER 30, 1952. Nov. 30, 1952. 17p. (AECU-2347(p.30-46))

Progress is briefly reported on the following studies: measurement of B^{10} and N^{14} energy levels by inelastic scattering of protons and deuterons, the $B^{10}(d,p)B^{11}$ reaction, a 20-register recorder for the cyclotron, and proton angular distribution from the reactions $S^{32}(d,p)S^{33}$, $Ca^{40}(d,p)Ca^{41}$, and $Cr^{52}(d,p)Cr^{53}$. (L.T.W.)

1693

Commissariat à l'Énergie Atomique (France)

L'ABAISSEMENT DES CHAMPS ENTRE CYLINDRES COAXIAUX AU MOYEN D'ÉCRANS INTERCALÉS. (REDUCTION OF FIELDS BETWEEN CO-AXIAL CYLINDERS BY MEANS OF INTERPOSED SCREENS), by J. Bernard, H. Bruck, and F. Prevot. May 1950. 18p. (CEA-47)

The dielectric rigidity of the space between two coaxial cylinders at a given potential can be increased by interposing coaxial cylindrical screens (the method of C. M. Turner, Thesis, Univ. of Wisconsin, 1943). The combination of screens reducing the maximum value of a simple field between two cylinders is calculated as a function of number of screens, their radius, and their potential, and, for a given number of screens, the optimum radii and potentials for maximum field reduction are determined. (tr-auth)

1694

Rensselaer Polytechnic Inst.

PROGRESS REPORT [FOR OCTOBER 1, 1951 TO SEPTEMBER 30, 1952,] by G. N. Glasoe, H. Landon, and W. A. McKinley. Oct. 1952. 48p. (NYO-869)

Progress is reported on the following studies: three-photon annihilation of the positron, energy loss of 624-kev electrons on passing through thin Al foils, angular studies and radiations from Zr^{95}, proportional-counter x-ray spectrometer, γ-ray spectrometry and pulse-height analysis, internal conversion electrons from Ba^{137}, and a high-speed coincidence circuit. (L.T.W.)

1695

Oak Ridge National Lab.

ENTHALPIES AND HEAT CAPACITIES OF STAINLESS STEEL (316), ZIRCONIUM, AND LITHIUM AT ELEVATED TEMPERATURES, by R. F. Redmond and J. Lones. Issued Dec. 30, 1952. 24p. (ORNL-1342)

The purpose of this investigation was the determination of the heat capacities of zirconium and lithium at elevated temperatures. In making these measurements, secondary information on the heat capacity of stainless steel and the relative enthalpies of the three materials at elevated temperatures were also obtained. The zirconium data extend the temperature range for which zirconium heat capacities have been reported. The lithium data have been obtained in an effort to appraise the widely differing results previously reported by other investigators. A bunsen ice calorimeter was used to determine the relative enthalpies of the materials as a function of temperature. The heat capacities were obtained by differentiating the experimentally determined enthalpy temperature equation $C_p = (\partial H/\partial T)_p$. (auth)

1696

Radiation Lab., Univ. of Calif., Berkeley

SUMMARY OF RESEARCH PROGRESS MEETINGS OF OCTOBER 16, 23, AND 30, 1952, by Sergey Shewchuck. Dec. 18, 1952. 3p. (UCRL-2059)

Values for the delay time in secondary electron emission as determined by several investigators are given in a discussion, by R. F. Post, of the delay problem in very fast scintillation counters. (L.M.T.)

1697

RESEARCH AT HARWELL—4. Atomics (London) 4, 20-2 (1953) Jan.

Some of the research activities at A.E.R.E., Harwell, very briefly reported are: studies of geometric packing of atoms in U alloys, metal-structure polarization studies, powder-metallurgy techniques, irradiation effects on metals, and ceramics-fabrication research. (L.M.T.)

1698

POSITRONIUM AND DEMATERIALIZATION OF THE POSITRON. J. D. Fox and J. Korringa. Nederland. Tijdschr. Natuurk. 18, 304-10(1952) Dec. (In Dutch)

A brief review discusses the energy levels of positronium, its annihilation, and experimental evidence for its lifetime and hyperfine structure. 17 references. (G.Y.)

ASTROPHYSICS

1699

Argonne National Lab.

THE EFFECT OF ELECTRON SCREENING ON THERMONUCLEAR ENERGY GENERATION, by Geoffrey Keller. Argonne National Lab. and Perkins Observatory. Nov. 1952. 10p. (AECU-2380; UAC-667)

It is known that thermonuclear reaction rates are sensitive to the heights of the intranuclear potential barrier. Since the height of the barrier will be reduced by the presence of screening electrons, computations have been made to determine the corresponding effect on the reaction rate of the carbon cycle. It has been found that under conditions typical of the interior of the sun, the reaction rate should be increased by a factor of 1.54. Under conditions representative of a red dwarf interior the increase is by a factor of 3 or more. Neither factor is likely to be important in the the-

ory of stellar structure unless it should turn out that the proton-proton reaction is inoperative. (auth)

COSMIC RADIATION

1700

Washington State Coll.

[PROGRESS REPORT ON] HIGH ENERGY COSMIC RAY SHOWERS UNDER THICK ABSORBERS [FOR] SEPTEMBER 1 TO DECEMBER 1, 1952, by T. G. Stinchcomb. Dec. 1, 1952. 5p. (NP-4353; Report No. 1)

A preliminary measurement of absorption in Pb of the high-energy shower-producing radiation is reported. A large scintillation counter was used, employing Pb absorbers 5 in. thick for part of the runs and 8 in. thick for the rest. The number of showers produced in the Pb that were able to produce a voltage pulse at the output of the linear amplifier of 20 v or larger for part of the runs and 40 v or larger for the rest is reported. The number of showers in Pb that were accompanied by air showers was measured and subtracted to eliminate the effect of air showers. The ratios of corrected frequencies under 5 in. of Pb to those under 8 in. of Pb indicate the absorption in Pb of the radiation producing the showers. With the effects of air showers eliminated the possible types of radiation at sea level giving rise to the measured showers in Pb are μ mesons and nucleons. The ratio of frequency of showers before the additional 3 in. of Pb is added to the final frequency is 1.04. (L.T.W)

1701

Iowa State Univ.

THE COSMIC RAY INTENSITY ABOVE THE ATMOSPHERE NEAR THE GEOMAGNETIC POLE, by James A. Van Allen. Jan. 1953. 42p. (SUI-53-1)

Measurements of cosmic-ray intensities near the north geomagnetic pole were made by the use of rocket-borne G-M counters to heights of more than 50 miles. These measurements confirm previous evidence for the marked flattening of the integral primary cosmic-ray spectrum below a magnetic rigidity of $\sim 1.5 \times 10^9$ v. Complete or nearly complete absence of the major components (H, He) of the primary radiation in the spectral regions 0.18×10^9 to 1.2×10^9 v (18 to 590 Mev) for H and 0.37×10^9 to 1.2×10^9 v (72 to 700 Mev) for He is indicated. This observed absence of low-rigidity primaries is not inconsistent with a solar dipole moment as large as 0.6×10^{34} gauss-cm^3. (L.T.W.)

1702

ZENITHAL DISTRIBUTION OF EXTENSIVE SHOWER PARTICLES. P. Bassi, A. M. Bianchi, D. Cadorin, and C. Manduchi. Nuovo cimento (9) 9, 1037-43(1952) Nov. (In Italian)

The authors report a measurement of the zenithal distribution of particles in extensive air showers performed with counters. Assuming a zenithal angle dependence of the form $\cos^n \vartheta$, a value of n is found between 3 and 4. The authors investigate its dependence on the height, the shower density, and the zenithal angle. (auth)

1703

NEW BAROMETRIC AND TEMPERATURE COEFFICIENTS FOR THE FREQUENCY OF SMALL COSMIC-RAY BURSTS. J. W. Broxon. Nuovo cimento (9) 9, 1054-70(1952) Nov. (In English)

This is a continuation of an earlier paper (NSA 5-4153). Records for 3 of the 19 months of the cosmic-ray observations primarily considered there have been reprocessed without satisfactory improvement of results. The statistical treatment of data for an earlier series of observations during 18 months in 1938 and 1939 has been completed with very satisfactory results. For a class of cosmic-ray bursts consisting of about 75 to 95 particles in a very heavily shielded high-pressure chamber at an altitude of 5440 ft, the barometric and atmospheric temperature coefficients have been found to be: -4.58%/mm Hg and -2.53%/°C, based on daily average values; and -9.05%/mm Hg and -2.19%/°C, based on monthly average values. With regard to coefficients based on daily average values, the ratio of the barometric coefficient of the radiation producing the small bursts to that of the radiation producing the burst-corrected ionization is about 26, while the corresponding ratio of the temperature coefficients is about 45. Discussion is included regarding the nature of the burst-producing radiation characterized by such large barometric and temperature coefficients. (auth)

1704

EFFECT OF LATITUDE ON THE INTENSITY OF COSMIC RADIATION DETERMINED WITH NUCLEAR EMULSIONS. Max Morand, Yvette Avignon, Lud van Rossum, and Roger Desprez. Compt. rend. 235, 1639-41(1952) Dec. 22. (In French)

The total intensity of the heavy component was studied under identical conditions (1920 m altitude) at Kebnekaise, Sweden (65°40′ geomagnetic latitude) and on Mont Ventoux, France (46°10′ geomatic latitude). An intensity ratio of 1.060 ± 0.026 was noted. (tr-auth)

1705

NEGATIVE PRIMARIES AS PART OF COSMIC RADIATION. B. Bhowmik. Phys. Rev. 89, 327-8(1953) Jan. 1.

This note gives treatment concerning the existence of negatively charged particles in the primary cosmic radiation. From an analysis of the experimental data on the azimuthal intensity variation it is concluded that the primary radiation probably contains about 20% negatively charged particles. (L.M.T.)

1706

LATERAL SPREADING OF LOW-ENERGY SHOWERS. G. Poiani and C. Villi. Nuovo cimento (9) 9, 1109-15(1952) Dec. (In Italian)

The integral spread, averaged over the longitudinal extension of an air shower, is calculated according to the unidimensional theory of the electrophotonic cascade developed by the Padua group. The expressions thus derived, which give numerical results in accordance with Roberg and Nordheim (Phys. Rev. 75, 444(1949)), describe the lateral spread in the low- and medium-energy region. In the high-energy region they give the relations stated by Borsellino. (Nuovo cimento 6, 543(1949); 7, 323,638(1950)). (auth)

1707

FURTHER RESULTS FROM THE STUDY OF SEA-LEVEL PENETRATING SHOWERS. W. Y. Chang, G. Del Castillo, and Leon Grodzins. Phys. Rev. 89, 408-11(1953) Jan. 15.

Thirty-five non-ionizing link showers (produced at a 17-g/cm^{2}Pb plate) associated with sea-level penetrating showers are presented. These have their axes oriented toward the origins of the penetrating showers and are believed to be cascade electronic showers initiated by high-energy photons, which are probably produced from the decay of π^0 mesons among the penetrating-shower particles. The size distribution of these showers is given showing a spread from 2 to 20 particles per shower. The angular distribution of their axes with respect to the penetrating shower axes is also approximately determined. Showers particles (of the penetrating showers) scattered by Be and Pb at angles greater than 10, 15, 20, 30, and 40° have been observed. The mean free path against scattering, and the corresponding scattering cross section per nucleon have been estimated in each case. The total scattering cross section per nucleon is of the order of magnitude of several millibarns. This figure may be compared with the total theoretical meson-nucleon scattering cross section calculated from pseudoscalar or scalar theory for meson energy equal to several times its rest energy. Perhaps, it is several times smaller

than the total experimental nucleon-nucleon scattering cross section for, say, 300-Mev proton energy. Our experimental cross section probably represents the combined effect of meson-nucleon and nucleon-nucleon scattering. (auth)

1708

SPARK COUNTERS FOR SHORT TIME INTERVAL COSMIC RAY MEASUREMENTS. E. Robinson. Proc. Phys. Soc. (London) A66, 73-8(1953) Jan. 1.

An original design of parallel-plate spark counter, developed especially for use in cosmic-ray experiments involving the measurement of mμsec time intervals, has a stable and trouble-free performance over many months of continuous operation. Distinctive features of the construction are the comparatively large sensitive area and the sealed-off type of assembly in glass. The counter time resolution obtainable under normal operating conditions is 5 mμsec. By using statistical methods it is possible to resolve time intervals down to 1 mμsec. An illustration of this is afforded by measurements of the mean velocity of cosmic-ray particles in the sea-level flux. (auth)

1709

PENETRATING PARTICLES IN EXTENSIVE AIR SHOWERS. A. L. Hodson. Proc. Phys. Soc. (London) A66, 65-72(1953) Jan. 1.

Extensive penetrating showers observed under a transition layer of Pb 10 cm thick are approximately 300 times more frequent at 30,000 ft than at sea level. A tentative analysis of their altitude variation suggests that the mean attenuation length in air of the N-component of extensive showers is of the order of 200 g/cm^2. It is shown that in extensive showers at 30,000 ft the fraction of particles which are penetrating is of the same order as at sea level. (auth)

1710

SOME ASPECTS OF THE ALTITUDE VARIATION OF EXTENSIVE AIR SHOWERS. A. L. Hodson. Proc. Phys. Soc. (London) A66, 49-64(1953) Jan. 1.

γ, the exponent of the density spectrum of extensive air showers, is found to increase from 1.445 ± 0.014 at sea level to 1.549 ± 0.018 at 26,000 ft. The values quoted are mean values for the density range 50 to 500 particles/m^2. The increase is considerably less than that predicted by cascade theory on the primary-electron hypothesis. It is suggested that the discrepancy may be explained by the formation of secondary cascade showers in a nucleon-cascade process. Extensive air showers recorded by a fixed experimental arrangement show a maximum frequency at about 26,000 ft. (8000 m). At that altitude the shower rate is found to be 42 times the rate at sea level. The barometer coefficient of extensive air showers at sea level is found to be $-9.0 \pm 1.1\%$ per cm Hg. Details are given of the quenching and hodoscope circuits used with the counters. (auth)

1711

MOMENTUM DISTRIBUTION FOR COSMIC RAY MESONS UP TO 6 KMEV/C. G. R. Heyland and W. E. Duncanson. Proc. Phys. Soc. (London) A66, 40-8(1953) Jan. 1.

The absorption curve and differential absorption curve have been determined for cosmic rays at sea level up to 365 cm (144 in.) of lead. Since similar curves were obtained for the differential absorption both by differentiating the absorption curve and by an anticoincidence method, the absorption curve was corrected for accidentals, showers, and scattering and used for subsequent determinations. The scattering correction is shown to be important. After subtraction of the soft component contribution from the absorption curve the momentum distribution for μ mesons is determined by making use of the range-momentum relation. This curve rises above the Rossi curve for momenta below 0.4 bev/c reaching a rather sharp maximum at about 0.16 bev/c. It is suggested that there are several factors contributing to this difference: (1) the soft component may not have been separated out completely and may be making a small contribution to the present curve at the low end, (2) in the present work the proton component has not been separated out and will make an effective contribution just in the region of the maximum, and (3) the effect of scattering may mean that the Rossi curve is rather low in this region. (auth)

1712

A SEARCH FOR IRREGULARITIES IN THE ABSORPTION OF COSMIC RAYS IN LEAD. G. R. Heyland and W. E. Duncanson. Proc. Phys. Soc. (London) A66, 33-9(1953) Jan. 1.

The integral absorption curve of cosmic rays has been examined at sea level up to a thickness of 365 cm of Pb. In the first place, the absorption curve was examined in sections using a control-telescope method to reduce the effects of atmospheric variation. It was found, to an accuracy of within about 1%, that there was no deviation from a monotonically decreasing curve. By a second method two regions of the curve, namely 0 to 30 cm and 7 to 193 cm, were examined in greater detail. Five G-M counter telescopes were employed so that five consecutive points on the absorption curve were determined simultaneously. No irregularities in the absorption curves for these two regions were found, and it was also shown for the 0 to 30 cm region that this was true whether the absorber was wholly above or wholly within the telescope. The fact that no irregularities were found in the 71 to 193 cm region (corresponding to a momentum range of about 1 to 3 bev/c μ mesons) indicates that the irregularities in the meson momentum spectrum suggested by Blackett, and by Glaser, Hamermesh, and Safonov are probably due to poor statistics. (auth)

1713

SHORT TIME INTERVAL MEASUREMENTS ON PAIRS OF ASSOCIATED COSMIC RAY PARTICLES. E. Robinson. Proc. Phys. Soc. (London) A66, 79-84(1953) Jan. 1.

Twofold coincidence rates for associated pairs of cosmic-ray particles have been measured at sea level as a function of their (small) horizontal separation. The parallel-plate spark counters used had a time resolution of 5×10^{-9} sec. Simultaneously with the rates, measurements of the time intervals between the arrival of the two particles at a given horizontal plane were made, both for counters in air and under 18 cm Pb. When allowance is made for the effect of spurious phenomena it is found that the coincidence rate falls off rapidly with increasing counter separation, that the particles forming the pairs are penetrating, and that they have a mean delay between them which is significantly greater than the resolving time of the counters. (auth)

1714

NOTE ON THE FLUCTUATION PROBLEM OF CASCADES. L. Jánossy. Proc. Phys. Soc. (London), A66, 117-18(1953) Jan. 1.

The purpose of this note is to correct an erroneous expression which occurred in the original paper (Jánossy, Proc. Phys. Soc. (London) A63, 241-9(1950)); NSA 4-4309). (L.M.T.)

ELECTRICAL DISCHARGE

1715

GASEOUS IONS AND THEIR REACTIONS. H. S. W. Massey. Discussions Faraday Soc., No. 12, 24-33(1952).

The first part is concerned with the nature of gaseous ions. Information available from experiments on the formation of clusters by alkali metal ions is discussed. Clusters are formed not only with polar molecules but also rare gas atoms. The recent work on the molecular ions of the rare gases also is described. Some special features of negative atomic and molecular ions are summarized, and attention is drawn to the importance of ions existing in metastable states.

The second part is concerned with the rates of reactions in which ions are involved. These are classified under five headings: reactions leading to production of positive ions, formation of negative ions, change in the nature of the ions, detachment of electrons from negative ions, and recombination. The different processes which can occur in these various categories are listed, and some indication of the factors which determine their rates is given. (auth)

ELECTRONS

1716

EXPERIMENTAL STUDY OF THE ELECTROSTATIC IMMERSION OBJECTIVE WITH PLANE ELECTRODES; FOCUSING CURVES AND FOCAL DISTANCE. Albert Septier. Compt. rend. 235, 1621-3(1952) Dec. 22. (In French)

Effects of the geometric parameters of the immersion objective, namely, the wehnelt-anode distance, radii of anode and wehnelt openings, and wehnelt thickness, on the electron-optical properties have been investigated. (G.Y.)

INSTRUMENTS

1717

Argonne National Lab.

APPARATUS FOR THE MEASUREMENT OF THE THERMAL CONDUCTIVITY OF SOLIDS, by James L. Weeks and Ralph L. Seifert. Dec. 8, 1952. 14p. (ANL-4938)

An apparatus has been developed with which thermal conductivities can be measured in the temperature range 40 to 100°C with a probable error of ±0.003 cal/sec-cm-deg or ±3%, whichever is the larger. It requires only a small sample (0.1875 × 0.1875 × 1.75 in.), does not require the attaching of thermocouples to the sample, and permits introduction and removal of the sample by remote control, if this is necessary. The apparatus is therefore especially useful to measure the thermal conductivity of large single crystals and also to observe the effect upon thermal conductivity of heat treatment, irradiation, or any other treatment which will not deform the sample yet which cannot be carried out readily with thermocouples attached to the sample. (auth)

1718

Brookhaven National Lab.

AN 800,000 r/hr COBALT-60 GAMMA SOURCE, by James S. Robertson and Aaron P. Sanders. Dec. 1952. 22p. (BNL-1330)

A high-intensity Co^{60} source, providing 8×10^5 r/hr in a small space, is described. The shielding requirements and use of the source for radiobiological studies are discussed. (auth)

1719

Los Alamos Scientific Lab.

A 100 WATT RADIO-FREQUENCY INDUCTION HEATER, by George N. Rupert. Dec. 1952. 14p. (LA-1486)

A small, low-powered induction heater whose power output is continuously adjustable from zero to more than 100 watts has been developed. A coaxial cable is used to transfer energy from the plate circuit of a power oscillator to a tuned circuit consisting of the heating coil and a condenser in parallel. No energy is radiated by the coaxial cable which may, therefore, be run through metal structures. Furthermore, since the leads between the coil and condenser in the parallel tuned circuit are very short, I^2R losses are low. (auth)

1720

Los Alamos Scientific Lab.

A THREE-RUN AUTOMATIC REGISTER, by George N. Rupert. Dec. 1952. 11p. (LA-1496)

The instrument described may be connected to any scaler by making a few wiring changes, and allows an operator to take up to three counting runs automatically. Since it is customary to take two or three runs for every sample counted, a considerable saving of time and effort is realized because the operator's attention is required only at the beginning of the first run. The switching operation from one run to the next is automatic and is accomplished in a fraction of a second. The time required to count a preset number of scaler impulses is indicated on one of three a-c clocks which record time in units of 0.01 min to a maximum of 99.99 min. The mechanical register which records scaler impulses may be set to turn off the run at 100, 500, 1000, 5000, or 10,000 impulses. Since the same number of impulses are counted in each run, the statistical error will remain constant for each series of runs. (auth)

1721

Wollensak Optical Co.

[PAPERS PRESENTED AT THE INTERNATIONAL SYMPOSIUM ON HIGH-SPEED PHOTOGRAPHY, by John H. Waddell.] Aug. 26, 1952. 41p. (NP-4329)

Many of the problems connected with the high-speed photography of atomic bomb explosions are discussed, including the general design problems connected with the cameras and related equipment. A complete description of the design features and specifications of the new full-frame 35-mm Fastax camera is given. A general discussion is given of the advances in spherical mirror optics and of the performance of new wide-angle lenses as aids to the high-speed photographer. (L.M.T.)

1722

Rochester Univ.

A STABLE AND LINEAR AMPLIFIER FOR THE MEASUREMENT OF SMALL DIRECT CURRENTS, by H. W. Fulbright. Oct. 17, 1952. 5p. (NYO-3707)

Design of a d-c amplifier employing an electrometer tube in its first stage and utilizing inverse feedback is reported. The amplifier has been used for a year without a breakdown for amplifying beam currents from the 26-in. cyclotron at the University of Rochester. Currents as small as 10^{-13} amp can be measured. It has a linear gain curve and shows no drift in gain and no appreciable zero drift after the brief preliminary warm-up period is over. A sketch of the basic circuit is included. (C.R.)

1723

A NEW PULSE-ANALYZER DESIGN. C. W. Johnstone. Nucleonics 11, No. 1, 36-41(1953) Jan.

The most noteworthy features of this design used for pulse-height analyzers are: (1) the input pulses pass through a special amplifier section similar to the ORNL "window" amplifier, (2) 6BN6 tubes with relatively large bias differences are used in the channel circuits for channel-width stability, and (3) the channel trigger circuits consist of one-tube univibrators which are triggered through the 6BN6's. In the description of the single- and 10-channel analyzers, some basic differences between the circuits and those of the ORNL analyzers are noted. Block and circuit diagrams are given. (L.M.T.)

1724

DECADES WITH FOUR DOUBLE TRIODES. R. Wahl. J. phys. radium 13, 670-1(1952) Dec. (In French)

A decade scaling circuit containing four double triodes and four Ge crystals is sketched. The scaler has a 2.5-μsec resolution time and can be constructed easily in unspecialized laboratories. (G.Y.)

1725

A SIMPLIFIED IONIZATION GAUGE CIRCUIT. F. J. Fitz Osborne. Can. J. Phys. 31, 11-14(1953) Jan.

By measuring the ratio of ion current to electron current present in the usual ionization gage, an extremely stable circuit has been developed, comparing favorably with standard

circuits. A simple calibration made during construction makes this gage direct reading. The circuit may be used for outgassing the gage, and for leak hunting, being very sensitive in this respect. It incorporates a safety cutoff, has relatively few controls, and is extremely cheap. The circuit described is simpler and more rugged, although just as useful and versatile, as the modified Rainwater instrument. (auth)

ISOTOPES

1726

PRESENCE OF Co AND Mn IN Fe^{55} PRODUCED IN THE PILE. A. Michalowicz and M. Lederer. J. phys. radium 13, 669-70(1952) Dec. (In French)

A strong γ-ray impurity in Fe^{55} produced in the Oak Ridge pile was compared with the γ spectra of Co^{60}; the two were found to be identical. Chromatographic separation confirmed this assignment and proved that no Mn^{54} was present. This contradicts the suggestion by Alper and Preez (NSA 4-4073) that the $Fe^{54}(n,p)Mn^{54}$ reaction has a high cross section. (G.Y.)

ISOTOPE SEPARATION

1727

THERMAL DIFFUSION IN ISOTOPIC MIXTURES IN THE CRITICAL REGION. F. E. Caskey and H. G. Drickamer. J. Chem. Phys. 21, 153-6(1953) Jan.

Thermal-diffusion ratios have been measured for the system $C^{14}O_2$-CO_2 temperature range −15°C to +50°C and to 160 atm. pressure. One isotherm at −15°C has also been measured for the system CH_4-CH_3H^3. The results deviate completely from the predictions of the kinetic theory of Enskog and Chapman and correspond closely to the previous results for the xenon-ethane system. The thermodynamics of irreversible processes qualitatively predicts the results obtained. (auth)

MASS SPECTROGRAPHY

1728

Naval Medical Research Inst., Bethesda

A MASS-SPECTROMETER-TUBE-UNIT PREALIGNING AND POSITIONING JIG FOR THE CONSOLIDATED 21-102 SPECTROMETER, by Louis P. Cecchini and James George. Aug. 1, 1952. 12p. (NM-000-018.07.20; Memo Report 52-8)

The construction of a jig for the external prealignment and positioning of mass spectrometer tube units (MSTU) in the Consolidated 21-102 mass spectrometer is described. Functions and illustrations of the constituent parts are given. It is to be expected that the more nearly optimum alignment of the MSTU, easily achieved with the use of the jig, will insure the attainment of the desired resolution, sensitivity, and reproducibility of ion patterns. (L.M.T.)

1729

ATOMIC MASS OF P^{31}. K. Ogata and H. Matsuda. Phys. Rev. 89, 333-4(1953) Jan. 1.

The mass difference of the doublets $P^{31}H^1$-S^{32}, $P^{31}(H^1)_2$-$S^{32}H^1$, and $(O^{16})_2$-$P^{31}H^1$ were measured with a modified Bainbridge-Jordan-type mass spectrograph. The atomic mass of P^{31} determined is 30.983619 ± 7 which compares well with the value obtained by Ewald of 30.983622 ± 23 (Z. Naturforsch. 6a, 293(1952)). (L.M.T.)

MATHEMATICS

1730

Kenyon Coll.

A MATHEMATICAL APPARATUS FOR QUANTUM-MECHANICS. PART I. PRELIMINARIES AND THEORY OF "TRACES," by Otton Martin Nikodym. [nd] 97p. (AECU-2386)

This paper is the first of four aiming at a new theory of hermitian self-adjoint operators in the separable and complete Hilbert-Hermite space and of normal maximal operators. The general theory of traces is developed and applied to Hilbert space. The Lebesguean theory of measurability is rigorously developed, and the motion of measure of a set is discussed. Frechet's integration theory is applied to complex-valued functions of a variable trace. The Boolean lattice of all borelian sets on the euclidean plane through a base whose elements are half-open rectangles is treated. Boolean lattices whose elements are closed subspaces of the Hilbert space are derived. (L.T.W.)

731

Oak Ridge National Lab.

NUMERICAL ANALYSIS OF BETA SPECTRA: I. NON-UNIQUE FORBIDDEN SPECTRA, by M. E. Rose. Issued Feb. 2, 1953. 7p. (ORNL-1464)

In the analysis of all beta spectra wherein the nuclear matrix elements enter only as a multiplicative factor, that is, allowed and spin change $\Delta j = n + 1$, parity change $\Delta\pi = (-)^n$ transitions, it is possible to construct a Kurie-Fermi plot. This is true when the interaction is a mixture as well as for pure interactions. When the transitions do not conform to the above, a simple graphical representation of the data does not seem feasible. For $\Delta j = n$, $\Delta\pi = (-)^n$ one has the following transitions which are presumably second forbidden: Cl^{36}, Tc^{99}, Tl^{204}, and possibly others. The first forbidden transitions seem to have the allowed shape, with the possible exception of RaE; therefore, at least second forbidden transitions are considered. The discussion given is devoted to the question of analyzing such spectra. (auth)

1732

AN IDENTITY SATISFIED BY THE RACAH COEFFICIENTS. L. C. Biedenharn. J. Math. Phys. 31, 287-93(1953) Jan.

Recursion formulas for the Racah coefficients are developed from which a general algebraic identity for the coefficients is derived. This identity is convenient for obtaining algebraic forms and numerical values for the coefficients. (L.T.W.)

MEASURING INSTRUMENTS AND TECHNIQUES

1733

Los Alamos Scientific Lab.

NEUTRON SCINTILLATION COUNTING BY THE $S(n,p)P^{32}$ PROCESS IN ZnS(Ag) PHOSPHORS, by G. R. Keepin. [nd] 8p. (AECU-2372; LADC-1330)

The mechanism of neutron counting in ZnS-lucite detectors is generally assumed due to recoil protons from the lucite producing light scintillations in the Ag-activated ZnS. However, upon investigation, 32% of the total counting rate was found to come from other sources. In a search for this background, the only known reactions in the energy range to be considered were $S(n,p)P^{32}$ and $S(n,\alpha)Si^{29}$. It was verified that S(n,p) is the predominant reaction for neutron detection in ZnS by the following methods: (1) measuring pulse-height distributions with ZnS(Ag), ZnS(Ag) in lucite, ZnS(Ag) in fluorothene, terphenyl in lucite, $CaWO_4$ in lucite, and stilbene in lucite, using a PoBe source, (2) measuring pulse-height distributions with three detectors, ZnS, ZnS in fluorothene, and ZnS in lucite with 3 sources (PoBe, PoLi, and Ra(γ)), and (3) by Bi attenuation studies. (L.M.T.)

1734

Washington Univ., St. Louis

TECHNICAL REPORT NO. 105 [ON] EXPERIMENTAL TECHNIQUES IN BETA-SPECTROSCOPY, by C. Sharp Cook. Jan. 28, 1953. 31p. (AECU-2383; Tech. Report No. 105)

This review is, in one sense, an extension of an article by Persico and Geoffrion (Rev. Sci. Instruments 21, 945 (1952)). However, the emphasis here is on experimental techniques and existing facts already determined as an aid

to the prospective builder of β spectrometers, rather than on theoretical predictions. The source, the detector, the intermediate regions within the spectrometer vacuum system, and the spectrometer equipment exclusive of the vacuum chamber are treated separately. 85 references. (L.M.T.)

1735
Atomic Energy Research Establishment, Harwell, Berks (England)
A 9" EXPANSION CLOUD CHAMBER, by H. S. Tomlinson, E. W. Titterton, and G. F. Snelling. Oct. 3, 1952. 13p. (AERE-G/R-1010)

A small mobile expansion chamber for use with particle accelerators has been constructed. A cylindrical chamber of 9-in. diameter and depth of 3 in. capable of working over the pressure range 20 cm of Hg to 2 atm.was chosen to provide adequate flexibility of experiment. To achieve fast expansions, so that counter control could be used where necessary, a rubber diaphragm-type chamber with an expansion orifice of 2 in. diameter was chosen. As uniformity of the magnetic field was necessary, air-cored field coils were adopted and this obviated the space restriction below the diaphragm which is usually necessary in chambers operated in conjunction with an iron-cored magnet. It was therefore possible to arrange that the air-flow conditions through the centrally situated orifice should be independent of the expansion ratio employed at any given time. The aim of the design was to maintain the gas motion in the active volume parallel to the chamber axis at all points during expansion. A further requirement was that the chamber should operate over long periods without adjustment of the expansion ratio. This was achieved by providing adequate cooling for the chamber and a heat shield for the field coils. (auth)

1736
Brookhaven National Lab.
THE ENERGY LOSS OF A FAST CHARGED PARTICLE BY ČERENKOV RADIATION, by R. M. Sternheimer. [nd] 3p. (BNL-1337)

For a medium with no absorption and described by a single type of dispersion oscillator, the relativistic rise of ionization loss has been shown by other workers to escape as Cherenkov radiation, in disagreement with the observed rise of the ionization pulse of μ mesons in crystals and with the relativistic rise of grain count in emulsion. The index of refraction has contributions from various absorption limits, and most of the Cherenkov radiation should occur near the line frequencies where the absorption coefficient is large. It is shown that when these effects are included the resulting energy escape is small (<0.01 Mev/g/cm^2) both for macroscopic crystals and for emulsion. (L.T.W.)

1737
Carbide and Carbon Chemicals Co. (K-25)
THICKNESS MEASUREMENTS OF THIN FILMS BY MULTIPLE-BEAM INTERFEROMETRY, by T. W. Bartlett and Frances L. Ball. May 13, 1952. 12p. (KLI-1425)

Two techniques are described for the measurement of the thickness of thin films by multiple-beam interferometry. Of these, the more useful was fringes of equal chromatic order. The standard deviation of replicate measurements of films less than 1000 A thick was rarely greater than 50 A. Deviations of this magnitude can be explained on the basis of the precision of measuring wave lengths with the spectrometer used. For silver films, the results by interferometry were 10 to 20% higher than the values calculated by weight gain except for the thinnest film measured when the interferometric value was 71 A, 50% higher. In the case of barium stearate films, differences between the measured and theoretical thicknesses were as high as 30%. (auth)

1738
Chemical and Physical Labs., Federal Telecommunication Labs., Inc.
NATIONAL DEFENSE CONTRACTUAL PROGRESS REPORT NO. 6 [ON] IONIZATION CHAMBER INSULATING MATERIAL; SECOND QUARTERLY REPORT [FOR] OCTOBER 15, 1951–JANUARY 15, 1952, by H. G. Nordlin, D. K. Keel, C. H. Mayhew, and S. Kaganoff. Jan. 1952. 53p. (NP-4264; National Defense Contractual Progress Report No. 6; U-20861)

Complete hydrogenation of polystyrene was accomplished with Ni oxalate catalyst:polymer ratios of about 1:1 at 140 to 160°C and 500 to 700 psi; cleaning and reactivation regenerated the catalyst. Molecular weights of the products varied over a wide range; the ratio of the highest to the lowest values was about 3:1. Molding at about 200°C caused a molecular-weight reduction, embrittlement, and a tendency to crack on cooling. A method was developed for accurately measuring the volume resistivity of dielectric samples during irradiation; the reduction in polystyrene volume resistivity was almost complete in 10 hrs of irradiations at 13 r/hr. The speed of recovery after irradiation was an inverse function of the total γ-radiation dosage; air and atmospheric-moisture effects were of secondary importance. The improvement observed in volume resistivities of a lubricated and a phenanthrene-containing polystyrene after prolonged electrification appeared limited to low RH conditions. Type-B specimens (SiO_2-filled polystyrene containing 50 vol. % SiO_2) had a volume resistivity about a decade lower than that of polystyrene alone; Cerrolow-147 sprayed-metal electrodes did not influence the conduction phenomenon. The volume resistivities of Styroflex and electrical-grade commercial polystyrene were almost identical. Dissipation factors of polystyrene increased 2.5 times at the low end of the 1000 to 100,000 c range during 500 r/hr γ irradiation; the dielectric constant was unaffected. A corresponding increase of about 1×10^{-3} occurred between 10 and 100 kc. The effect disappeared when radiation was stopped. (See also TIP U20108) (TID-LC)

1739
Chemical and Physical Labs., Federal Telecommunication Labs., Inc.
NATIONAL DEFENSE CONTRACTUAL PROGRESS REPORT NO. 3 [ON] IONIZATION CHAMBER INSULATING MATERIAL; FIRST QUARTERLY REPORT [FOR] JULY 15 – OCTOBER 15, 1951, by H. G. Nordlin, D. K. Keel, C. H. Mayhew, and S. Kaganoff. Oct. 1951. 53p. (NP-4265; ATI-121284; National Defense Contractual Progress Report No. 3; U-20108)

A reproducible method for the hydrogenation of polystyrene was developed by using reduced Ni-oxalate catalyst. The reactor liner of a rocking autoclave was charged with the catalyst and 250 ml of a 2 to 4% solution of polystyrene in decalin. The liner was then purged and charged with H at 1000 psig. The autoclave was heated to 132 to 178°C with rocking and pressure increases to 1400 psig. The reaction proceeded for 4 hrs; after cooling, the product was separated from the reaction mixture. The volume resistivity of polystyrene type-B samples increased on storage over silica gel for 3 mo; that of a Teflon sample increased to more than $10^{21.2}$ Ω-cm after being electrified at 510 v for 8 days. (cf. TIP U19238) (TID-LC)

1740
Chemical and Physical Labs., Federal Telecommunication Labs., Inc.
NATIONAL DEFENSE CONTRACTUAL PROGRESS REPORT NO. 9 [ON] IONIZATION CHAMBER INSULATING MATERIAL; THIRD QUARTERLY REPORT [FOR] JANUARY 15–APRIL 15, 1952 by H. G. Nordlin and D. K. Keel. Apr. 1952.

28p. (NP-4266; National Defense Contractual Progress Report No. 9; U-22031)

Measurements of volume resistivity during γ irradiation were extended to a range of 0.5 to 170 r/hr. The logarithmic plot of volume resistivity (ρ_V) vs. dosage rate/hr (r) for Koppers 8X polystyrene (I) gave the mathematical relation $\rho_V = 1.8 \times 10^{19}/r^{0.72}$ Ω-cm. The ρ_V during 170 r/hr irradiation increased about 0.1 decade for an increase in field strength from about 7 to 80 v/mil. The Styroflex ρ_V was about 0.5 decade lower than the polystyrene ρ_V at dosages of 11 and 170 r/hr. Extrapolation to the background rate of about 0.01 mr/hr gave ρ_V's of 9×10^{20} and 6×10^{22} Ω-cm for Styroflex and I, respectively. Recovery curves for I after irradiation showed an inverse relationship between recovery speed and duration of the prior irradiation. The behavior of I with C electrodes was essentially the same as with metal electrodes; the latter apparently had little effect on the conduction phenomenon. A product receiver and sample-tube manifold were constructed for the styrene distillation apparatus. A large-volume vacuum still was installed before the main still for triple distillation of commercial styrene monomer in He without exposure to the atmosphere. (cf. TIP U20861) (TID-LC)

1741

[Applied Research Labs., Glendale, Calif.]
FIRST QUARTERLY REPORT [ON] RESEARCH INVESTIGATIONS DIRECTED TOWARD ESTABLISHMENT OF METHODS FOR QUANTITATIVE SPECTROGRAPHIC ANALYSES OF RAW AND PROCESSED MATERIALS [FOR] NOVEMBER 15, 1951 TO JANUARY 15, 1952, by M. F. Hasler and J. W. Kemp. 15p. (NP-4343)

A Be-Cu multiplier phototube for the detection of soft x rays and a high-current tube for the generation of soft x rays are described. Comparison of various detectors of fluorescent x radiation from elements 19 through 30 are reported. Thin-windowed Geiger counters designed for α-particle detection give the highest sensitivity and signal-to-background ratio for this range of radiations. Preliminary studies with a nondispersive analyzer indicate that elements in this region can be individually detected. (auth)

1742

SELECTIVE DEVELOPMENT OF NUCLEAR EMULSIONS; DISCRIMINATION BETWEEN TRACKS AND GAMMA CLOUDING. Maurice Gailloud and Charles Haenny. Mém. soc. vaud. sci. nat. 10, 271-94(1952) Nov. 15. (In French)

A 2-r γ irradiation completely blackens Ilford C2 nuclear emulsion developed normally. The best conditions for selective underdevelopment have been studied, the clear appearance of tracks of ionizing particles (U α and B(n,α)Li particles) with respect to the γ clouding being the criterion. Electrochemical properties of three new developers have been compared, and the limit of discrimination has been extended from 40 to 200 r. A surface developer containing photographic glycine has been found to be often superior to the developers customarily in use. This is explained by considerations of the structure of the latent image. (G.Y.)

1743

ACTINOMETRY OF IONIZING RADIATION. N. Miller and J. Wilkinson. Discussions Faraday Soc., No. 12, 50-60 (1952).

A number of systems which have recently been proposed for the chemical dosimetry of ionizing radiation are compared and criticized, the object being to review the present position and assist others who may be considering the use of these methods. (auth)

1744

TECHNICAL QUESTIONS ON CHERENKOV RADIATION DETECTORS. I. P. Bassi and A. M. Bianchi. Nuovo cimento (9) 9, 1087-91(1952) Nov. (In Italian)

The authors report a measurement of the dependence on the refractive index of the radiated Cherenkov energy. A fluorescence in plexiglass and water was observed which is comparable to the Cherenkov effect. (auth)

1745

ON THE OPERATION OF THE DIFFUSION CLOUD CHAMBER. C. Succi and G. Tagliaferri. Nuovo cimento (9) 9, 1092-1102(1952) Nov. (In English)

An experimental model of downward diffusion cloud chamber has been constructed, and the performance of the instrument has been investigated. Satisfactory ion tracks are easily obtained, and chamber operation is stable over considerable periods of time, when some care is devoted to maintain the most suitable boundary conditions. The effect of ion load on the depth of the sensitive layer is deduced by tracing plots of supersaturation distribution. Remarks advising a convenient choice of chamber gas and vapor are appended. (auth)

1746

A SLOW COMPONENT IN THE DECAY OF THE SCINTILLATION PHOSPHORS. Jasper A. Jackson and F. B. Harrison. Phys. Rev. 89, 322(1953) Jan. 1.

Measurements were made of the fraction of light emitted by 5 phosphors, terphenyl in toluene 5 g/l, terphenyl crystal, trans-stilbene, anthracene, and NaI. The phosphor was placed in a beaker lined with Al foil, excited by an x-ray beam, and viewed by an end-window photomultiplier. The circuit was arranged so that when the photomultiplier was gated on, the x-ray tube was gated off, and vice versa, the x-ray beam turning back on after 40 μsec. Data show an extremely short mean life of fluorescence in the terphenyl solution and also the absence of a slow component. The decay time and per cent of light emitted are given for each of the other 4 phosphors. (L.M.T.)

1747

ATOMIC INSTRUMENTS—2. NEW EQUIPMENT FOR NUCLEAR RESEARCH. Atomics (London) 4, 16-19(1953) Jan.

A number of interesting types of automatic counters, pulse analyzers, radiation detectors, and time analyzers for atomic-energy research and applications that have been developed of late by government establishments, universities, technical institutes, and private firms in various countries are reviewed. Many of these were shown by these organizations at the recent 3rd International Instruments and Measurements Exhibition at Stockholm. (auth)

1748

TWO LIQUID SCINTILLATION NEUTRON DETECTORS. C. O. Muehlhause and G. E. Thomas, Jr. Nucleonics 11, No. 1, 44-8(1953) Jan.

A slow-neutron counter employing borates in an organic scintillator has been tested and shows a response time of 5 μsec with a γ sensitivity of ~2%/g/cm^2. The best liquid scintillator found so far employs 2,5-diphenyloxazole which for equal volumes of methyl borate and phenylcyclohexane and for solubility to ~−20°C, is 4 g/l 2,5-diphenyloxazole and 16 mg/l diphenylhexatriene. A comparison with a thermal-neutron flux meter showed the counting efficiency to be ~100%, and the mean life for neutron capture in the energy region in which the $1/v$ law for B is operative is ~0.42 μsec for enriched B^{10} material and 2.2 μsec for normal material. A design is also suggested for a fast-neutron counter which, it is believed, will be insensitive to γ rays and slow neutrons and which should have a response time of 5×10^{-9} sec. (L.M.T.)

1749

A REVIEW OF SCINTILLATION COUNTING. PART I. R. B. Owen. Atomics (London) 4, 5-10(1953) Jan.

As a result of the development of suitable photomultiplier tubes and phosphors, scintillation counting techniques are now being employed on an increasing scale. This article re-

views the various photomultipliers that are commercially available and the characteristics of the phosphors that can be used, together with some types of scintillation-counting equipment and spectrometers that are now in use. (auth)

1750

A HIGH-RESOLUTION DETECTOR FOR HIGH-INTENSITY RADIATION. W. C. Hall, B. M. Horton, J. W. Keller, and S. H. Liebson. Nucleonics 11, No. 1, 49-55(1953) Jan.

The design, construction, and operating characteristics of this detector, an RCA C7154 coaxial phototube surrounded by a scintillator, are discussed. The scintillator used is a mixture of ½% terphenyl in toluene. The resolution of the detector is $\sim 2 \times 10^{-9}$ sec and it has an output current linear with light input up to 20 amperes. The integration of signals, a disadvantage when ionization chambers are employed in high-intensity measurements, is overcome with this detector for signals whose intensity variation is slow when compared with the resolution of the detector. (L.M.T.)

1751

ELIMINATION OF DEAD-TIME CORRECTIONS IN MONITORED GEIGER COUNTER X-RAY MEASUREMENTS. J. N. Eastabrook and J. W. Hughes. Research (London) 6, Suppl., 7S(1953) Jan.

Heretofore, when a monitor scaler was used in conjunction with a Geiger-counter x-ray spectrometer and quenching circuit, corrections had to be made at each reading. This has been overcome by an addition to the system which arranges that neither spectrometer nor monitor scaler can record while either is quenched. A gate valve is used in each recording channel between the quench circuit and the scaler, and each gate valve gives an output to its scaler only if (a) its own Geiger counter operates, (b) the other counter is not quenched, and (c) x rays are being generated. A block diagram of the revised system is given with explanation of the function of each component. (L.M.T.)

1752

PERFORMANCE OF A PARTICULAR COINCIDENCE CIRCUIT. F. Demichelis and R. Malvano. Nuovo cimento (9) 9, 1227-31 (1952) Dec. (In Italian)

Variation of the resolving time of a particular coincidence circuit with the energy of γ rays detected by scintillation counters is discussed. Application to measurement of the average energy of γ rays is suggested. (auth)

1753

DISCHARGE MECHANISM IN ARGON COUNTERS. L. Colli and U. Facchini. Nuovo cimento (9) 9, 1183-1217(1952) Dec. (In Italian)

Multiplication curves and pulse shapes have been studied in a counter filled with pure A and A-CO_2 mixtures at pressures from 150 to 1000 mm Hg. The pulse shapes in A in the high proportional zone and up to voltages corresponding to the corona threshold are explained by assuming a production in the Townsend avalanche of photons hard enough to extract electrons from the cathode. Analysis of the features of excited levels of A suggests the four lower excited levels to be responsible for the photoelectric effect. No processes other than the photoelectric one have been found to be efficient in counters filled with A-CO_2 mixtures up to proportions of 5×10^{-3}. At higher percentages the photoelectric process is considerably reduced; there it has been found to be effective in the discharge build-up, a process by which electrons are released in the gas body. The counter behaves as a regular fast counter. The effect of Hg vapor in the discharge in pure A is also described, and is accounted for by the well-known Penning process of Hg ionization by collision on excited A atoms. This process causes the discharge to start at extremely low multiplication values. (G.Y.)

1754

INVESTIGATION OF TRACKS WITH WEAK MULTIPLE SCATTERING AT MINIMUM IONIZATION FOUND IN NUCLEAR EMULSIONS. Takashi Mikumo and Monique Maitrot. J. phys. radium 13, 609-18(1952) Dec. (In French)

After rapidly reviewing the methods capable of identifying tracks near the ionization minimum, the authors study the energy spectrum of cosmic-ray tracks found at sea level in Ilford G5 plates of 200 μ thickness developed 10 to 20 days after their formation. The energy spectrum in plates with high track density is different from the spectrum in plates with low track density. In the first case, there is probably a majority of electrons from cascade showers, in the second, a majority of mesons. For the purpose of identifying individually each electron track, the authors attempt to prove an energy difference between the two ends of the tracks. (tr-auth)

1755

ELEMENTARY THEORY OF GENERATING FUNCTIONS. APPLICATION TO STATISTICAL FLUCTUATIONS IN SCINTILLATION COUNTERS. Paul Maignan, D. Blanc, and J. F. Detoeuf. J. phys. radium 13, 661-7(1952) Dec. (In French)

The theory of generating functions is succinctly outlined. Its application to statistical fluctuations in a scintillation detector circuit is developed for two cases, those of thin and thick scintillators. (tr-auth)

1756

ABSOLUTE LIGHT EMISSION EFFICIENCY OF CRYSTAL ANTHRACENE FOR GAMMA-RAY EXCITATION. Milton Furst, Hartmut Kallmann, and Bernard Kramer. Phys. Rev. 89, 416-17(1953) Jan. 15.

The absolute light-emission efficiency of crystal anthracene has been reported in the range from ½% to 4% and in the vicinity of 10%. Further determinations involving integrated light-intensity measurements are reported here, which give an efficiency of about 10%. The possibility of the discrepancies being due to the use of peak-height measurements in one set of experiments and integrated intensities in the others is discussed; preliminary experiments indicate that the difference in range of values is not due to this cause. (auth)

1757

STOPPING POWER OF C2 NUCLEAR EMULSIONS FOR α PARTICLES. J. Catalá, J. Aguilar, and F. Busquets. Anales real soc. españ. fís. y quím. A48, 326-7(1952) Nov.-Dec. (In Spanish)

A graph of the stopping power of Ilford C2 nuclear emulsion for 2.5- to 19-Mev α particles was determined from the well-known values of energies and ranges for these particles in emulsion and air. (auth)

1758

ENERGY LOSS OF HIGHLY CHARGED PARTICLES PRODUCED BY FISSION AND BY COSMIC RAYS. SECTION I. OBSERVATIONS OF FISSION FRAGMENTS. Pierre Demers. Can. J. Phys. 31, 78-96(1953) Jan.

Measurements on the range of the tracks of fission fragments recorded in special laboratory-made emulsions are reported. The origin was marked so that observations on length not otherwise possible were made. Stopping power and straggling for such tracks in different media are discussed. It is shown that the range of one fragment is little dependent on the range of the other paired fragment. The blackening of the two tracks near the origin is on the average unequal, that of the light fragment L being darker. It is inferred that ionization is greater near the origin for the L fragment. Knock-on protons allow a range velocity curve to be drawn, and evidence is advanced to prove that the light associated particles are indeed knock-on protons. 22 references. (auth)

1759

ENERGY LOSS OF HIGHLY CHARGED PARTICLES PRODUCED BY FISSION AND BY COSMIC RAYS. SECTION II.

PHOTOMETRIC MEASUREMENTS ON FISSION FRAGMENTS. Roger Mathieu and Pierre Demers. Can. J. Phys. 31, 97-111 (1953) Jan.

A sensitive and accurate photometer is described, which is designed to measure directly the light intensity transmitted through very small objects placed under the microscope at the highest resolving powers. Tracks of mesons, protons, α rays, and fission fragments were examined with it, characteristic curves relating optical density D and ionizing power I were obtained and show the feature, unusual for light sensitivity, of two sensitive regions separated by a region of very low gamma. The variation of optical density and of width with ionizing power is discussed for three types of emulsion. Measurements on fission tracks are analyzed to derive a single range ionization relation $I = 1.22 + 0.738\ R$, in Mev and microns, applicable to both heavy and light fragments. The controversial literature on this matter is discussed. 22 references. (auth)

1760

THE REDUCTION OF DISTORTION IN NUCLEAR-RESEARCH EMULSION. A. J. Herz and M. Edgar. Proc. Phys. Soc. (London) A66, 115-16(1953) Jan. 1.

Two sample plates coated with 1000-μ-thick Ilford G5 emulsion were processed together at ~5°C except that a dry warm stage (27°C, 30 min) was applied to one of them. Photographs show much more distortion (parallel to the glass base) in the plate to which the warm stage was applied. The exact mechanism by which a dry warm stage can cause distortion is not known, but it is thought that some kind of "annealing" takes place during a warm stage which changes the directional properties of the emulsion. (L.M.T.)

1761

A PRECISION MEASUREMENT OF THE ^{137}Cs γ-LINE. G. Lindström, K. Siegbahn, and A. H. Wapstra. Proc. Phys. Soc. (London) B66, 54-9(1953) Jan. 1.

The recent establishment of a set of standard lines for precision work in β-ray spectroscopy is reviewed. In this work use was made of a semicircular spectrometer adjusted for high resolution, the proton resonance method for measuring the magnetic field, and a large double-focusing spectrometer. In this way absolute measurements of the lines were made, as well as a number of different relative measurements. The general consistency is very satisfactory, indicating a precision of the standard lines of 1 or 2 parts in 10^4. So far the following lines have been measured: the F, I, L, and X lines of Th(B,C'), the 411-kev line of Au^{198}, the annihilation radiation, the 2.75-Mev line of Na^{24}, the 662-kev line of Cs^{137}. In this paper the measurements of the Cs^{137} are described. The line has been studied as a conversion line and as a photo line emanating from a U converter. The combined results of the two spectrometers yield the following value of the energy of the Cs^{137} line: $E_\gamma = 661.65 \pm 0.15$ kev. The $H\rho$ value of the conversion line is 3381.28 ± 0.50 gauss-cm. (auth)

MESONS

1762

Laboratory for Nuclear Science, Mass. Inst. of Tech. SYNCHROTRON GROUP and THEORETICAL GROUP, p.47-55 of TWENTY-SEVENTH PROGRESS REPORT FOR PERIOD AUGUST 31, 1952 TO NOVEMBER 30, 1952. Nov. 30, 1952. 9p. (AECU-2347(p.47-55))

Angular distribution of π^+ mesons from γ irradiation of H and production of π^- and π^+ mesons from γ irradiation of Be are briefly reported. (L.T.W.)

1763

Radiation Lab., Univ. of Calif., Berkeley

LARGE ANGLE SCATTERING OF NEGATIVE PIONS IN ALUMINUM, COPPER, AND LEAD (thesis), by H. H. Heckman. Dec. 23, 1952. 51p. (UCRL-2062)

A new technique is used to measure the cross sections for large angle scattering of negative pions as they traverse a semiinfinite scatterer. A stripped emulsion is embedded in the scatterer, exposed to an incident beam of π^- mesons, and scanned. Most of the mesons stop at the expected distance from the absorber edge as determined from the range-energy relation. A few mesons are found at smaller depths of penetration and are attributed to large-angle scattering. Star-forming mesons that enter the emulsion traveling opposite (90°-180°) to the direction of the incident beam are attributed to nuclear backscattering and are used in the cross-section calculation. This method affords an effective solid angle of 2π steradians for observing nuclear backscattering. The cross section is proportional to the ratio of backward flux to incident flux, both of which are observed in the same strip of emulsion. The conclusions of this investigation are that the scattering of negative pions from complex nuclei is consistent with energy independence in the region of 32 ± 10 Mev, the S- and P-waves contribute to backscattering, and the cross section for backscattering is proportional to the mass number, A, which indicates that pion-nucleon collisions are observed. The calculations of the cross sections include corrections for inelastic collisions. The total nuclear backscattering cross sections for negative pions in Al, Cu, and Pb are 59.6 ± 11 mb, 192 ± 27 mb, and 577 ± 80 mb, respectively. (auth)

1764

RELATION BETWEEN THE PHOTOPRODUCTION AND SCATTERING CROSS SECTIONS FOR π -MESONS IN COMPLEX NUCLEI. Norman C. Francis and Kenneth M. Watson. Phys. Rev. 89, 328-9(1953) Jan. 1.

In nuclei of mass number $A \geq 10$, the cross sections for photoproduction of charged π mesons has been found to vary as $A^{2/3}$. From "optical model" considerations the question has been raised whether this A dependence can be interpreted as due to the reabsorption of produced mesons. In this note both the photoproduction and absorption cross sections are calculated and the results show that both have approximately the same A dependence. It is concluded that the A dependence does not seem to be inconsistent with the optical model. (L.M.T.)

1765

A SUGGESTED SCHEME FOR MESON PRODUCTION. H. Messel and H. S. Green. Phys. Rev. 89, 315-16(1953) Jan. 1.

A classification of all observed particles with masses intermediate between the π meson and the proton and with masses greater than the proton seems desirable. This note suggests such a classification based on the properties of first-order wave equations, suggests the existence of isobaric excited states of the nucleon, and proposes a model for the structure of the nucleon. 18 references. (L.M.T.)

1766

MEAN LIFE OF THE V_1^0 PARTICLE. Bernard d'Espagnat. Compt. rend. 235, 1610-12(1952) Dec. 22. (In French)

It is shown to be possible to explain the half lives of the V_1^0 particle ($V_1^0 \rightarrow p + \pi^-$) and π meson ($\pi \rightarrow \mu + \nu$) by means of a single coupling constant, on condition that the coupling is pseudovector and not pseudoscalar. (tr-auth)

1767

PROBABLE EMISSION OF A NUCLEAR FRAGMENT CONTAINING A V^0 PARTICLE. Jean Crussard and Daniel Morellet. Compt. rend. 236, 64-6(1953) Jan. 5. (In French).

A giant star of 60 branches, of which ~30 were of minimum ionization, produced by a very-high-energy $Z = 1$ particle was observed in 600-μ-thick Ilford G5 emulsion exposed under 3 cm of Cu at sounding-balloon elevation. Interest centers in a dense track 68 μ in length ending in a small 3-prong star. This

event is interpreted as an abnormal α particle or Li^7 nucleus, in which a V_1^0 particle has replaced a neutron, coming to rest and decaying: $\alpha^* \rightarrow He^3 + H^1 + \pi^-$ or $Li^{7*} \rightarrow Li^6 + H^1 + \pi^-$. That the dense track was that of a heavy meson, which was captured by a nucleus with subsequent emission of a π meson, is not impossible but has less supporting evidence. (G.Y.)

1768

PHOTOPRODUCTION OF NEUTRAL MESONS IN HYDROGEN. Y. Goldschmidt-Clermont, L. S. Osborne, and M. B. Scott. Phys. Rev. 89, 329-30(1953) Jan. 1.

The γ-ray beam from a synchrotron operating at 320 Mev was passed along the axis of a cylindrical chamber filled with H at 655 psi and 60°C. Photoproduction of π^0 mesons was investigated by placing nuclear emulsions halfway along the cylinder, the arrangement allowing all protons scattered through angles >8° to be recorded. A plot is given of the excitation curve vs. the quantity p^3k, where p and k are the momentum of the meson and the γ ray, respectively, in the c.m. system. The curve is seen to be proportional to p^3k in the low-energy region. The angular distribution in the c.m. system is found to be symmetrical with respect to $90 \pm 2°$. (L.M.T.)

1769

THE ANGULAR AND ENERGY DISTRIBUTIONS IN PHOTOMESON PRODUCTION. Bernard T. Feld. Phys. Rev. 89, 330-1(1953) Jan. 1.

A phenomenological theory developed by Brueckner and Watson (Phys. Rev. 86, 923(1952)) for the photoproduction of π^0 mesons is examined with the idea of extracting from the experimental information those aspects which are independent of any special meson theory. It is noted that no different results are obtained, but some of their results are restated to help emphasize the general character of the conclusions and to highlight their physical significance. (L.M.T.)

1770

ASYMMETRIC FISSION. Peter Fong. Phys. Rev. 89, 332-3(1953) Jan. 1.

The nucleus at the saddle point of the energy in the fission process has been found to be symmetric. This note proposes that the mode of fission is still undetermined at the saddle point, however, and is concerned with what takes place from the saddle point to a much later stage when the fission fragments are just about ready to come apart. The number of quantum states at this late stage, which will determine the mode of fission, favors asymmetric fission over symmetric. This is because the internal excitation energy, E, of the fragments at the breaking point is larger for the asymmetric mode. From a formula for E, all possible mass splittings can be calculated and from a derived quantitative relation between E and the no. of quantum states a mass distribution curve can be derived. The calculated mass distribution curve for U^{235} is given. (L.M.T.)

1771

REMARKS ON FEYNMAN'S METHOD FOR CHARGED MESONS OF SPIN 1. Maurice Jean and Jacques Prentki. J. phys. radium 13, 669(1952) Dec. (In French)

The dissymmetry between absorption and emission of real mesons requires certain modifications in the quantum-electrodynamical rule for the sum of polarizations. In addition, a more symmetrical form of Feynman's rules (Phys. Rev. 76, 769(1949)) for charged spin-1 mesons is possible. (G.Y.)

NUCLEAR PHYSICS

1772

ON THE NUCLEAR SHELL MODEL AS BASIS FOR CALCULATING NUCLEAR ENERGY LEVELS. Johannes Hermanus van der Merwe. Ph.D. Thesis, Leyden Univ. Leyden, De Jong, 1952. 44p.

The possibility of assuming one-particle motion for excited nuclear states is discussed and attempt is made to make the one-particle motion plausible. The most favored one-particle theory, the Mayer-Jensen theory, is investigated and seems to form a promising starting point for discussions about nuclear structure and interpretations of nuclear data. Some calculations are made on nuclei for which one might expect the one-particle approximation to hold for the lower excited states. These calculations show that the correct order of level separation follows from a very simple one-particle model in which the radius of the nuclear field is about twice as large as the conventional radius for non-excited nuclei. (L.M.T.)

1773

THE GROUND STATE OF N^{14}. A. M. Feingold. Phys. Rev. 89, 318(1953) Jan. 1.

Explanation of the large ft value, 10^9, for the C^{14} β decay has been that the ground state of N^{14} is an almost pure $^3D_1$ state, the C^{14} ground state being a $^1S_0$ state as in other even-even nuclei. In this note an alternative explanation suggested for the forbiddeness of the β decay is that the ground state of N^{14} is predominatly a P state, either $^3P_1$ or $^1P_1$. (L.M.T.)

1774

ANGULAR MOMENTUM DISTRIBUTION OF NUCLEONS IN THE NUCLEUS. P. Gombás. Acta Phys. Acad. Sci. Hung. 2, 247-59(1952). (In German)

On the basis of the statistical model of the nucleus and with the aid of nucleon density distributions calculated in two preceding papers, the neutron and proton numbers from which are built up the s, p, d, ... neutron and proton levels are determined. These neutron and proton numbers agree well with those obtained from the wave-mechanical nuclear-shell model. Of importance is the agreement of these numbers, as well as the difference between the density distribution of the neutrons and protons, with empirical results. (tr-auth)

1775

STATISTICAL THEORY OF THE NUCLEUS. II. P. Gombás. Acta Phys. Acad. Sci. Hung. 2, 223-46(1952). (In German)

Presentation of the statistical theory of the nucleus continues with calculation of density distribution of the nucleons and nuclear energy in the second approximation and discussion of the difference between neutron and proton distributions. (G.Y.)

1776

LIFETIMES OF NUCLEAR ISOMERS. Steven A. Moszkowski. Phys. Rev. 89, 474-82(1953) Jan. 15.

Lifetimes of nuclear isomers for gamma transitions are calculated theoretically on the basis of various independent-particle models; e.g., single proton, single neutron, and states of several particles. The calculations are essentially restricted to the most common type of transition, viz., multipole order equal to spin change. The lifetime is expressed in terms of a matrix element, M, whose theoretical value depends on the particular model of the nucleus. Radical integrals are calculated numerically, assuming that the nuclear wave functions are given by single-particle wave functions for a spherical square well. Empirical values of M^2 can be deduced from measured isomeric lifetimes corrected for internal conversion. An analysis of empirical M^2 for some gamma transitions points to a number of regularities which, in general, speak in favor of an independent-particle model. The regularities are the following: Empirical values of M^2 for M4 transitions are of order unity and show little scattering and no distinction between odd-proton and odd-neutron nuclei. The lack of scattering within each group of transitions is consistent with predictions of a single-particle model. However, according to this model, one would expect odd-proton nuclei to have lifetimes about half as large as

odd-neutron nuclei for the same transition energy, and also would expect lifetimes about $^1/_{10}$ as large as found empirically. Empirical values of M^2 for M4 transitions appear to be larger for transitions in nuclei with nearly closed shells. According to an independent-particle model, M^2 for E3 transitions of energy 100 kev should be of order 10^{-8} for single-neutron transitions, and vanish for many-particle transitions, such as those between $p_{1/2}$ and 7/2+ states. The fact that empirical M^2 for E3 transitions are small can be interpreted as resulting from small deviations from an independent-particle model. In fact, empirical M^2 for transitions between $p_{1/2}$ and 7/2+ states in odd-neutron nuclei appear to be smaller the more nearly the nucleus can be represented as a closed-shell nucleus. The empirical value of M^2 for an M1 isomeric transition in Li^7 is slightly larger than expected according to an independent-particle model. A graph of energy levels for a spherical square-well potential is presented. 26 references. (auth)

1777

INTERNATIONAL CONFERENCE ON NUCLEAR PHYSICS AT COPENHAGEN, JUNE 3 TO 17, 1952. P. M. Endt, H. J. Groenewald, and S. A. Wouthuysen. Nederland. Tijdschr. Natuurk. 18, 292-303(1952) Dec. (In Dutch)

Information presented at the conference, held under the auspices of the European Council for Nuclear Research, on low-energy nuclear reactions, properties of mesons, design of accelerators, and theoretical physics is condensed. Purpose of the conference was to present the actual problems in physics of elementary particles to be considered by the Council in its plans for construction of accelerators for the European nuclear physics laboratory. (G.Y.)

1778

THE EFFECT OF THE TENSOR FORCE ON THE BINDING ENERGY OF THE ALPHA-PARTICLE. J. Irving. Proc. Phys. Soc. (London) A66, 17-28(1953) Jan. 1.

The binding energy of the He^4 nucleus is calculated by the variation method, assuming charge-independent neutral two-body forces, using Yukawa wells, not necessarily of the same range, for the central and tensor parts of the interaction. The wave function chosen represents a mixture of the principal $^1S_0$ and the principal $^5D_0$ states, the radial wave functions being of a simple exponential type. With the nuclear parameters adjusted to fit the deuteron energy and quadrupole moment, and other low-energy data, it is found that the introduction of the tensor force greatly reduces the large value of the He^4 energy obtained in the purely central-force case. Whereas equal ranges yield a very small binding, the unequal ranges, which according to Pease and Feshbach fit the triton, give reasonable values for He^4. Thus it seems possible that a phenomenological two-body interaction of the above type may give consistent results in the two-, three-, and four-body problems. For the triton the same type of wave function gives rather poor results, compared with another exponential function used previously.

NUCLEAR PROPERTIES

1779

Wisconsin Univ.

ENERGY LEVELS IN N^{14} AND C^{14} FROM DEUTERON BOMBARDMENT OF C^{13}, by R. E. Benenson. nd 36p. (AECU-2354)

An approximately 50-kev-thick carbon target enriched to 61 percent C^{13} was bombarded by 3.89-Mev deuterons. The neutrons resulting from the $C^{13}(d,n)N^{14}$ and $C^{12}(d,n)N^{13}$ reactions were detected in photographic emulsions placed at angles of 0, 20, 45, and 80° with respect to the incident beam. It was possible to examine the energy-level scheme of N^{14} up to 8.1 Mev excitation and by means of Butler's stripping theory to assign parities to the first three excited states. Energy levels of N^{14} are located in this experiment at 2.23 ± 0.10, 3.85 ± 0.08, 4.80 ± 0.07, 4.97 ± 0.07, 5.76 ± 0.05, 6.23 ± 0.05, 6.43 ± 0.04, 7.00 ± 0.04, 7.72 ± 0.04, and 8.08 ± 0.06 Mev excitation with possible levels at 5.5 ± 0.1, 6.1 ± 0.1, and 7.50 ± 0.04 Mev excitation. The parities of the 2.23- and 3.85-Mev levels are found to be even with $J \leq 2$ while that of the 4.8 Mev level is found to be odd with J = 0 or 1. As an auxiliary experiment, the $C^{13}(d,p)C^{14}$ reaction was investigated at six angles of observation again by use of photographic emulsions. No levels clearly ascribable to C^{14} were observed below the known 6.1-Mev excited state. This state appears to have odd parity, J = 0 or 1. (auth)

1780

Purdue Univ.

THE ANGULAR MOMENTA OF THE EXCITED STATES OF Pt^{196}, by Rolf M. Steffen. [nd] 7p. (AECU-2365)

A remeasurement of the Pt^{196} γ-γ angular correlation was performed using especial care to avoid the detection of scattered radiation. The results are consistent with the assignment 2,2,0 for the angular momenta of the excited states and ground state, respectively, the first transition being a mixture of 95% quadrupole and 5% dipole radiation, and the components are out of phase. Internal-conversion data are consistent with both transitions being mainly electric quadrupole, indicating the same parity for all three levels involved. (L.M.T.)

1781

INTERPRETATION OF ISOMERIC TRANSITIONS OF ELECTRIC QUADRUPOLE TYPE. Aage Bohr and Ben R. Mottelson. Phys. Rev. 89, 316-17(1953) Jan. 1.

An interpretation is given of certain electric quadrupole isomeric transitions in which the lifetimes are appreciably shorter than those predicted by the shell theory. A nuclear model describing the nucleus in terms of the coupled single-particle motion and nuclear-surface oscillations is used. The nuclides examined are Er^{166}, Yb^{170}, Hf^{178}, Os^{186}, Hg^{196}, and Pb^{204}. The factor by which the transition probability exceeds that calculated for a single-proton transition of type $d_{3/2} \rightarrow S_{1/2}$ is determined and the intrinsic quadrupole moments for the fast transitions are calculated. (L.M.T.)

1782

VALIDITY OF BORN APPROXIMATION IN STRIPPING. N. Austern. Phys. Rev. 89, 318-9(1953) Jan. 1.

Explanation is given of why the Born approximation, usually considered unreliable for low-energy reactions, gives results which are in good agreement with those of Butler (Proc. Roy. Soc. (London) 208, 559(1951)) when applied to the deuteron stripping process. It is shown that the result of the Born approximation can be obtained by another route, employing only the physically plausible assumptions of Butler. The calculation is presented as for an infinitely heavy target with coulomb interaction with the deuteron omitted. (L.M.T.)

1783

THE HALF-LIFE OF EUROPIUM-152, 154. J. Kastner. Can. J. Phys. 31, 169(1953) Jan.

Further work to determine the half lives of Eu^{152} and Eu^{154} is reported. A normal Eu sample was irradiated in the Chalk River reactor, and the γ intensity is being compared with that of a 250 mg Ra standard. The comparison is being made at intervals of a few weeks and now covers over 200 days. Results thus far indicate good agreement with those of Karraker, Hayden, and Inghram (Phys. Rev. 87, 901(1952)) of 13 ± 2 yrs for Eu^{152} and 16 ± 4 yrs for Eu^{154}. (L.M.T.)

1784

NUCLEAR MAGNETIC RESONANCE LINE WIDTH TRANSITION IN ALUMINIUM. E. F. W. Seymour. Proc. Phys. Soc. (London) A66, 85-8(1953) Jan. 1.

The nuclear magnetic resonance absorption line due to Al^{27} in the metal exhibits a line width transition centered at

330°C. The connection with diffusion processes is discussed. (auth)

1785

ALIGNMENT OF ATOMIC NUCLEI. J. A. Beun. Nederland. Tijdschr. Natuurk. 18, 245-58(1952) Oct. (In Dutch)

A brief review of methods for detecting nuclear alignment is presented. 20 references. (G.Y.)

NUCLEAR REACTORS

1786

Argonne National Lab.

COMPUTATION FORMS FOR SOLUTION OF CRITICAL PROBLEMS BY TWO-GROUP DIFFUSION THEORY, by B. I. Spinrad and Dieter Kurath. Mar. 1952. 26p. (ANL-4352)

Computing forms are described for use in evaluating the critical multiplication of symmetrical one-dimensional reactors, and in obtaining the two group flux curves. (C.R.)

1787

THE REACTOR AS A NEUTRON SOURCE. D. J. Hughes. Nucleonics 11, No. 1. 30-5(1953) Jan.

The characteristics of neutrons available from research reactors are discussed, classifying them energy-wise into three groups according to the manner in which they are produced in the reactor. These are: (1) fast, those produced in fission which have not been moderated, (2) resonance, those which comprise the 1/E spectrum produced by moderation and usually range from 1 Mev to 1 ev, and (3) thermal, those which have reached equilibrium with the graphite and possess a Maxwellian distribution of velocities. The energy distribution, flux, and spatial distribution of each group is discussed and the fission spectrum is given. (L.M.T.)

1788

THE PROBLEM OF DOSIMETRY IN THE PILE. J. Wright. Discussions Faraday Soc., No. 12, 60-72(1952).

Since energy absorption from pile radiation is high enough for calorimetric measurement at reasonable pile powers, such measurements when complete should provide a basis of dosimetry for pile radiation chemistry. Monitors are required for each individual irradiation so that the dose can be related to that received in unit time in the calorimeter. Nuclear physical monitors are not entirely satisfactory, but it may be possible to use as monitors chemical systems whose behavior has been studied under carefully controlled conditions. Experiments on the irradiation of various systems are described, and it is shown that the oxidation of ferrous sulfate in 0.8N H_2SO_4 provides a suitable monitor for short irradiations. Experiments in which this system is used to study transient pile phenomena provide information about one component of pile radiation—the γ radiation resulting from decay of fission products. The results show the importance of attaining steady pile conditions and emphasize the fallibility of megawatt-hours as a measure of dose. Certain results suggest that the chemical effects of neutrons and of γ rays are not always additive for a mixed source, but further confirmation by more direct experiments is being sought. The experiments described in the present paper have been designed and monitored in such a way that they can be related to the calorimetric measurements when these are complete. It will then be possible to derive G values for pile radiation for the various systems studied. (auth)

NUCLEAR TRANSFORMATION

1789

Los Alamos Scientific Lab.

THE (n,γ) AND (n,2n) REACTIONS IN IODINE, by H. C. Martin and R. F. Taschek. [nd] 5p. (AECU-2384; LADC-1334)

Cross sections for the $I^{127}(n,\gamma)I^{128}$ reaction from 0.25 to 1.6 Mev and the $I^{127}(n,2n)I^{126}$ reaction from 12 to 18 Mev were measured by irradiating NaI(Tl) crystals and observing the induced activity with a photomultiplier. The cross sections are plotted as functions of neutron energy. The estimated error in the (n,γ) cross section is ±7%, and the energy spread for each value is ~50 kev. The cross section is nearly proportional to 1/E in this energy range. The error in the (n,2n) cross section at 14.1 Mev is ±6%. The neutron energy spread at each point is ~0.7 Mev. A threshold of 9.52 ± 0.20 Mev was determined for the reaction. (L.T.W.)

1790

Brookhaven National Lab.

ELECTRON–RECOIL NUCLEUS CORRELATION EXPERIMENTS ON He^6, by Brice M. Rustad and Stanley L. Ruby, Brookhaven National Lab. and Columbia Univ. [nd] 5p. (BNL-1333)

The correlation between the electron and the recoil nucleus in the He^6-Li^6 decay was studied to determine whether the tensor or axial-vector interaction should be retained in β-theory formulation. Plots are given of (1) the coincidence rate measured at angles from 110 to 180° between the direction of the electron and recoil nucleus, and (2) coincidence counting rate at 180° vs. the energy of the β ray. The agreement between the experimental results and the tensor-interaction curves indicates that the tensor interaction predominates. (L.M.T.)

1791

Los Alamos Scientific Lab.

ABSOLUTE CROSS SECTION FOR THE REACTION $T(d,n)He^4$ FROM 10 TO 120 KEV, by W. R. Arnold, J. A. Phillips, G. A. Sawyer, E. J. Stovall, Jr., and J. L. Tuck. Oct. 1952. 38p. (LA-1479)

The cross section for the reaction $T(d,n)He^4$ over the low-energy range from 10 to 120 kev has been measured at about 90 points by an absolute method. This method used a deuteron beam passing into a thin tritium gas target; the alpha particles from the reaction were observed at 90° (lab.). The total cross sections obtained, assuming isotropic distribution in the c.m. system, show a peak of 4.95 barns at 107 kev deuteron energy. The probable error in these measurements is estimated at ±3% at 100 kev, 3.5% at 25 kev, 10% at 10 kev. A Gamow plot with the theoretical slope passes through the measured points at 20 and 16 kev. This leads to the relation

$$\sigma(\text{barns}) = \frac{2.26 \times 10^4}{E} e^{-44.46E^{-\frac{1}{2}}}$$

with E the deuteron energy expressed in kev. For cross sections below 16 kev, this relation is preferable to the experimental values since systematic errors could be large. (auth)

1792

Los Alamos Scientific Lab.

THE CROSS SECTION FOR THE $He^3(d,p)He^4$ REACTION FROM 35-100 KEV, by W. R. Arnold, J. A. Phillips, G. A. Sawyer, E. J. Stovall, Jr., and J. L. Tuck. Oct. 1952. 8p. (LA-1481)

The 90° differential cross section for the reaction $He^3(d,p)He^4$ was measured by an absolute method using a gas target. Resulting total cross sections, assuming an isotropic angular distribution in the center-of-mass system, are: at 100 kev deuteron energy, $\sigma_{D\text{-}He^3} = 20$ mb; at 35 kev deuteron energy, $\sigma_{D\text{-}He^3} = 11$ mb. The experimental error is estimated at ±5% at 100 kev. The total cross sections obey, within the experimental error, a relation

$$\sigma_{D\text{-}He^3\,\text{total (barns)}} = \frac{1.82 \times 10^4}{E} e^{-91.0E^{-\frac{1}{2}}}$$

(auth).

1793
DISSYMMETRY OF FISSION AND THE DROP MODEL. Pierre Demers. Compt. rend. 235, 1637-9(1952) Dec. 22. (In French)

The asymmetry of nuclear fission is explained by capillary forces in the nucleus during the separation. (tr-auth)

1794
OBSERVATION OF THE $(\gamma,2n)$ REACTION IN Ta. E. A. Whalin and A. O. Hanson. Phys. Rev. 89, 324-5(1953) Jan. 1.

In this experiment the total neutron yield and (γ,n) radioactivity from bombardment of Ta with x rays from a 22-Mev betatron are measured under the same conditions. The $(\gamma,2n)$ yield is obtained from the difference between the two excitation curves. Data are obtained for the (γ,n) and $(\gamma,2n)$ cross sections by the photon difference method of Katz and Cameron (Can. J. Phys. 29, 518(1951)). Thresholds for the (γ,n) and $(\gamma,2n)$ are 7.7 and 14.0 Mev, respectively. A plot of the experimental ratio of the $(\gamma,2n)$ to the total cross section from 14 to 22 Mev is somewhat smaller than the calculated ratio. Apparently the effect of the $(\gamma,2n)$ reaction is to increase the width of the curve for the total cross section while having very little effect on the position of the maximum. (L.M.T.)

1795
A Li^9 DISINTEGRATION IN A PHOTOGRAPHIC EMULSION. W. F. Fry. Phys. Rev. 89, 325-6(1953) Jan. 1.

This note reports a meson-induced star observed in a G-5 plate exposed to the μ-meson beam of the Univ. of Chicago cyclotron. The proposed event is the result of the disintegration of Li^9, the reaction taking place the following way:

$$Li^9 \rightarrow e^- + \nu + Be^9$$
$$Be^9 \rightarrow \alpha + \alpha + n + Q.$$

The energy released in the breakup of Be^9 was found to be 4.4 ± 0.8 Mev and indications are that the Be^9 decayed from the 6.8 Mev level. A partial energy level diagram of Li^9 and Be^9 is given. (L.M.T.)

1796
A SCALER USING DEKATRON SCALING TUBES. NOTE ON THE CROSS SECTION OF THE REACTION $^{31}P(n,p)^{31}Si$. Ingvar Nilsson. Acta Polytech. Elec. Eng. 4, No. 8(1952) 8p.

A G-M scaler using dekatron scaling tubes has been designed and constructed. The function of the dekatrons is described, and a complete circuit diagram is given. A calibration curve is also shown indicating that the scaler could be used up to 1000 cpm with a coincidence loss smaller than 3%. An investigation has been made of the cross-section variation of the reaction $P^{31}(n,p)Si^{31}$ for neutrons with energies between 2.05 and 3.25 Mev. The result is presented in a curve, indicating resonances for neutron energies of 2.25, 2.37, 2.55, 2.70, 2.87, 3.02, 3.15, and 3.22 Mev. (auth)

1797
NUCLEAR PHOTODISINTEGRATION OF B^{10} AND B^{11} BY γ RAYS UP TO 31 MEV. R. Müller and P. Stoll. Nuovo cimento (9) 9, 1232-36(1952) Dec. (In German)

The reactions $B^{10}(\gamma,d)2He^4$ and $B^{11}(\gamma,t)2He^4$ were investigated with Kodak NT1 plates, using the bremsstrahlung spectrum of a 31-Mev betatron. Cross sections for the reactions are plotted, and excited states of the Be^8 intermediate nucleus are discussed. (G.Y.)

1798
THE EXCITED STATES OF THE N^{13} NUCLEUS. Herbert L. Jackson and Aaron I. Galonsky. Phys. Rev. 89, 370-4(1953) Jan. 15.

The properties of the excited states of N^{13} were reinvestigated by applying dispersion theory to the $C^{12}(p,p)C^{12}$ differential cross section reported in the preceding paper [abst. 1820]. The quantity and accuracy of the data were sufficient to permit extraction of the experimental S-wave phase shift up to 1.4 Mev. The remainder of the data was fitted by successive readjustment of the level parameters. The present analysis corroborates the previous momentum and parity assignments but gives somewhat different values for the resonant energies and widths. The level assignments together with the revised widths and resonant energies are as follows: The 0.46-Mev scattering anomaly is due to a virtual ($j = 1/2$, +) level in the compound nucleus N^{13} with $E_\gamma = 2.369$ Mev and $\Gamma = 31$ kev. The 1.7-Mev scattering anomaly is the result of two virtual levels, a ($j = 3/2$, −) level with $E_\gamma = 3.511$ Mev and $\Gamma = 55$ kev and a ($j = 5/2$, +) level with $E_\gamma = 3.558$ Mev and $\Gamma = 61$ kev. E_γ and Γ are calculated in the center-of-mass system and E_γ is measured from the ground state of N^{13}. These new values for E_γ and Γ agree quite well with those obtained from the $C^{12}(p,\gamma)N^{13}$ reaction provided it is assumed that the ($j = 5/2$, +) level does not participate appreciably in the capture process. The values of the reduced widths of the levels indicate that the two even-parity levels arise mainly from single-particle excitation, but that the odd-parity level involves appreciable excitation of the core. 13 references. (auth)

1799
HEAT OF REACTION OF THE $Be^9(d,t)Be^8$ PROCESS. J. Catalá, F. Senent, and J. Casanova. Anales real soc. españ. fís. y quím. A48, 323-5(1952) Nov.-Dec. (In Spanish)

A value of $Q = 4.60 \pm 0.03$ Mev was found for the $Be^9(d,t)Be^8$ reaction by range measurements of the tritons in Ilford C2 nuclear plates. (auth)

1800
MAGNETIC ANALYSIS OF THE $Sr^{88}(d,p)Sr^{89}$ REACTION. Charles E. McFarland and Franklin B. Shull. Phys. Rev. 89, 489(1953) Jan. 15.

A magnetic analyzer was used to study proton groups produced when a $SrCO_3$ target was bombarded with 10.43-Mev deuterons. Three excited states of Sr^{89} were found in addition to the ground state. The corresponding Q values are 4.33, 3.26, 2.26, and 1.79 Mev. (auth)

1801
MAGNETIC ANALYSIS OF THE DEUTERON-BERYLLIUM REACTIONS. R. W. Gelinas and S. S. Hanna. Phys. Rev. 89, 483-8(1953) Jan. 15.

The charged-particle spectra from the deuteron bombardment of Be^9 have been analyzed magnetically with a spectrograph employing a second-order focus. Previously established transitions to states in Be^{10} and Li^7 were observed, and a careful search of the proton and alpha spectra failed to disclose additional states in these nuclei, throughout the region explored. The excitation energy of the second excited state of Li^7 was determined as 4.62 ± 0.02 Mev. The transition to the broad first excited state of Be^8, as well as to the ground state, was revealed in the triton spectrum. Alpha and triton continue resulting from the three-particle disintegrations, $Be^9(d,\alpha)Li^{7**}(\alpha)t$ and $Be^9(d,t)Be^{8*}(\alpha)\alpha$, were also observed and examined in some detail. Other three-particle disintegrations appear improbable but cannot be definitely excluded, at the bombarding energies employed from 0.5 to 1.0 Mev. 13 references. (auth)

1802
NEUTRON CAPTURE γ-RAYS FROM TITANIUM, CHROMIUM, IRON, NICKEL, AND ZINC. B. B. Kinsey and G. A. Bartholomew. Phys. Rev. 89, 375-85(1953) Jan. 15.

The neutron-capture γ rays emitted by the even-charge elements, from titanium to zinc, have been investigated with the aid of a pair spectrometer. Titanium emits a very simple spectrum. Two strong γ rays, 6.756 ± 0.006 and 6.412 ± 0.006 Mev, are produced by capture in Ti^{48}. Neither the direct transition to the ground state of Ti^{49}, nor the transitions to the ground states of Ti^{48} and Ti^{50} were detected. From chromium the γ rays corresponding to transitions to the ground state (9.716 ± 0.007 Mev) and to the first excited

state (8.881 ± 0.007 Mev) of Cr^{54} are prominent and have intensities of 13 and 35 photons per 100 captures in Cr^{53}. The direct transition to the ground state of Cr^{51} was not detected. The iron spectrum is dominated by a strong γ ray with the energy 7.639 ± 0.004 Mev resulting from neutron capture in Fe^{56}. This γ ray is produced in the transition in Fe^{57} either to the ground state or to the excited state at 14 kev. Two weaker γ rays with nearly equal energies close to 6 Mev are also produced in this isotope. The ground-state γ ray and the γ rays leading to the first two excited states of Fe^{55} have been identified. Of these, the ground-state γ ray (9.298 ± 0.007 Mev) is strong, about 50 photons per 100 captures in Fe^{54}. A part of the counting rate ascribed to this γ ray, however, may be due to the γ ray producing the first excited state of Fe^{55} in a direct transition. The ground-state γ ray in Fe^{58} (10.16 ± 0.04 Mev) accounts for about 5 percent of all captures by Fe^{57}. The nickel spectrum contains an intense γ ray with an energy of 8.997 ± 0.005 Mev, which is produced in 50 percent of the captures in Ni^{58}. Another prominent γ ray at 8.532 ± 0.008 Mev may represent the transition to the ground state in Ni^{61}; if so, it accounts for some 80 percent of captures in Ni^{60}. From considerations of intensity, five of the remaining nickel γ rays can be ascribed to transitions to excited states in Ni^{59}. In the spectrum of zinc, few discrete γ rays can be discerned above a background of unresolved radiations. Of these, a very strong γ ray, with an energy to 7.876 ± 0.007 Mev, probably producing directly the ground state of Zn^{65}, is emitted in 40 percent of neutron captures by Zn^{64}. 27 references. (auth)

1803

NEUTRON CAPTURE γ-RAYS FROM SCANDIUM, VANADIUM MANGANESE, COBALT, AND COPPER. G. A. Bartholomew and B. B. Kinsey. Phys. Rev. 89, 386-95(1953) Jan. 15.

The neutron-capture γ-ray spectrum from scandium consists of an exceptionally large number of γ rays, and those of highest energy are only partially resolved when the line width in the coincidence spectrum is 130 kev. The γ ray corresponding to the direct transition to the ground state in Sc^{46} (8.85 ± 0.08 Mev), if correctly identified, has an intensity of 0.3 photon per 100 captures. Vanadium produces several strong γ rays with intensities of about 10 photons per 100 captures. Of these, the γ ray with the highest energy, 7.305 ± 0.007 Mev, can be identified with the transition to the ground state of V^{52}. A group of partially resolved γ rays with energies between 7.6 and 8.0 Mev are tentatively ascribed to capture in the rare isotope V^{50}. If this interpretation is correct, the isotopic capture cross section of V^{50} probably lies between 40 and 400 barns. The transition to the ground state in V^{51} was not detected. In manganese the transition to the ground state (7.261 ± 0.006 Mev) is stronger than any other γ ray in the spectrum (12 photons per 100 captures). With a line width of 100 kev it is only partially resolved from another strong γ ray with an energy of 7.15 ± 0.02 Mev. The remainder of the manganese spectrum is complex. From cobalt, about six γ rays are produced each with intensities of the order of 5 photons per 100 captures. The γ ray with the highest energy (7.486 ± 0.006 Mev) may be identified with either the transition to the ground state or to the isomeric state at 59 kev. The copper spectrum is dominated by the strong γ ray producing the ground state in Cu^{64}. Its energy is 7.914 ± 0.006 Mev and its intensity is 24 photons per 100 captures in Cu^{63}. Another strong γ ray at 7.634 ± 0.006 Mev may be the transition to the ground state of Cu^{66}. 34 references. (auth)

1804

FURTHER MEASUREMENTS ON THE γ RAYS PRODUCED BY NEUTRON CAPTURE IN BERYLLIUM AND CARBON. G. A. Bartholomew and B. B. Kinsey. Can. J. Phys. 31, 49-54(1953) Jan.

New measurements have been made of the neutron-capture radiation from beryllium and carbon using a more sensitive pair spectrometer. From beryllium, γ rays with energies of 6.81 and 3.41 ± 0.06 Mev were detected. The former is the ground-state γ ray previously reported. The 3.41 Mev γ ray, which has an intensity of about 0.25 photon per capture, seems to be due to the excitation of the first excited state in Be^{10}. From carbon, in addition to the 4.95 Mev ground-state γ ray previously reported, a γ ray was found with an energy of 3.68 ± 0.05 Mev and with an intensity of about 0.3 photon per capture. No γ rays were observed which could be associated with the excitation of the level at 3.9 Mev in C^{13}. 19 references. (auth)

1805

PHOTONEUTRON CROSS SECTIONS IN SILICON AND CALCIUM. R. G. Summers-Gill, R. N. H. Haslam, and L. Katz. Can. J. Phys. 31, 70-7(1953) Jan.

Using the dropping apparatus and dose-monitoring method previously reported, (NSA 6-4932), the cross sections for the reactions $Si^{28}(\gamma,n)Si^{27}$ and $Ca^{40}(\gamma,n)Ca^{39}$ have been measured by detecting positron activities in the residual nuclei. The $Si^{28}(\gamma,n)Si^{27}$ cross section has a peak value of 21 mb at 20.9 Mev and an integrated cross section to 24 Mev of 0.070 Mev-b. The threshold energy is 16.9 ± 0.1 Mev. The $Ca^{40}(\gamma,n)Ca^{39}$ cross section has a peak value of 15 mb at 19.3 Mev and an integrated cross section to 24 Mev of 0.065 Mev-b. The threshold is 15.8 ± 0.1 Mev. A comparison of results with the neutron-yield measurement of Price and Kerst at 18 and 22 Mev gives good agreement. A further comparison with the neutron-yield work of Baldwin and Elder is made. The sharp discontinuity in (γ,n) yields using lithium γ rays observed by Wäffler and Hirzel is explained as a threshold effect. Integrated cross sections increase more or less smoothly with Z. In addition, improved values for the half lives of the residual nuclei Si^{27} and Ca^{39} have been measured. These are 4.45 ± 0.05 and 1.00 ± 0.03 sec, respectively. 26 references. (auth)

1806

SOME FEATURES OF THE DEUTERON STRIPPING PROCESS. R. H. Dalitz. Proc. Phys. Soc. (London) A66, 18-32 (1953) Jan. 1.

The stripping model of Butler is presented in a simpler, more intuitive form, which is used to show that the outgoing nucleons are unpolarized, and to calculate the statistical matrix of the final nucleus, from which the angular distribution of later radiation may be calculated by the method of Spiers. (auth)

1807

AN INVESTIGATION OF THE NEUTRON GROUPS FROM THE REACTIONS $^{12}C(d,n)^{13}N$, $^{16}O(d,n)^{17}F$ and $^{32}S(d,n)^{33}Cl$. R. Middleton, F. A. El-Bedewi, and C. T. Tai. Proc. Phys. Soc. (London) A66, 95-107(1953) Jan. 1.

The experimental arrangement and method of investigation by the photographic plate technique of (d,n) reaction at a deuteron bombarding energy of 8 Mev are described. The positions are reported of some of the energy levels of the residual nuclei N^{13}, F^{17}, and Cl^{33}. It has also been possible to determine spins and parities of the corresponding levels from measurements of the angular distributions of some of the neutron groups. A comparison of the mirror nuclei $C^{13}N^{13}$, $O^{17}F^{17}$, and $S^{33}Cl^{33}$ is made. (auth)

1808

AN INVESTIGATION OF THE REACTION $^{14}N(d,n)^{15}O$ AT 8 MEV DEUTERON ENERGY. W. H. Evans, T. S. Green, and R. Middleton. Proc. Phys. Soc. (London) A66, 108-14(1953) Jan. 1.

The neutrons emitted from a nitrogen gas target bombarded by 7.7 Mev deuterons have been investigated using the photographic plate technique. The existence of six excited

states of O^{15} has been established and certain predictions about the spins and parities of these levels have been made by comparing the observed angular distributions of the corresponding neutron groups with those based on a nuclear stripping theory. 17 references. (auth)

PARTICLE ACCELERATORS

1809

Radiation Lab., Univ. of Calif., Berkeley

SUMMARY OF RESEARCH PROGRESS MEETING OF SEPTEMBER 18, 1952, by Sergey Shewchuck. Dec. 16, 1952. 9p. (UCRL-2055)

Nuclear Elastic Scattering of 300 Mev Neutrons. William P. Ball. The details of this talk appear in report UCRL-1938 of the same title. A New Strong Focusing Accelerator Design Principle. D. L. Judd. Principles of the magnetic focusing technique, proposed recently by Brookhaven National Lab., for production of accelerator beams in the multiple-bev region are described. The variational differential equation of particle motion is discussed for several periodic boundary conditions, and the equation is applied to magnetic focusing in proton synchrotrons when the Hill-Meisner condition is satisfied. (L.T.W.)

1810

STRONG-FOCUSING SYNCHROTRON — DESIGN AND COST DATA. M. Stanley Livingston. Nucleonics 11, No. 1., 12-15 (1953) Jan.

The newly-developed strong-focusing principle seems to make possible the construction of a synchrotron to produce 100-bev particles. This focusing into a smaller aperture comes as a result of making a change in the magnet positioning. The theory is discussed and data, including cost estimates, are given for the possible future construction of the 100-bev accelerator. (L.M.T.)

1811

A NEW GENERAL EXTRACTION PRINCIPLE FOR ION SOURCES; APPLICATIONS TO DIFFERENT TYPES OF SOURCES. I. PRINCIPLES. II. EXPERIMENTAL RESULTS. J. Sommeria. J. phys. radium 13, 645-57(1952) Dec. (In French)

Experimental studies with the "cathode lens," which were summarized in a letter to the editor (J. phys. radium 13, 491 (1952); NSA 7-342), are reported in detail. 17 figures. (G.Y.)

1812

RADIATION BY ELECTRONS IN CIRCULAR ACCELERATORS. P. H. J. A. Kleijnen. Nederland. Tijdschr. Natuurk. 18, 265-72(1952) Nov. (In Dutch)

The direction, energy, and spectrum of the electromagnetic radiation emitted by electrons accelerated in circular orbits are discussed briefly. (G.Y.)

1813

PHASE STABILITY OF THE MICROTRON. C. Henderson, F. F. Heymann, and R. E. Jennings. Proc. Phys. Soc. (London) B66, 41-9(1953) Jan. 1.

The limits of phase and energy within which electrons can be stably accelerated in a microtron are calculated for a number of voltages by two different methods. The effect of small changes in the magnetic field are considered, and the energy and phase of electrons after the first transit are given for different resonator gaps and voltages. Finally, the design of resonator and the operating conditions likely to give maximum output from this type of machine are discussed. (auth)

1814

PERTURBATIONS IN THE MAGNETIC DEFLECTOR FOR SYNCHRO-CYCLOTRONS. K. J. Le Couteur. Proc. Phys. Soc. (London) B66, 25-32(1953) Jan. 1.

Previously the linearized equation of motion of particles in the deflector were solved exactly; now the effect of non-linear terms, proportional to d^2H/dr^2, is evaluated approximately. The results indicate the tolerances on the field shape and the desirable radial position of the deflector. (auth)

RADIATION ABSORPTION AND SCATTERING

1815

Wisconsin Univ.

PROTON-PROTON SCATTERING FROM 1.8 MEV TO 4.2 MEV, by H. R. Worthington, J. N. McGruer, and D. E. Findley. [nd] 56p. (AECU-2353)

Measurements of the scattering of protons by protons have been made at six energies in the range from 1.8 to 4.2 Mev. At each energy the differential cross section was measured as a function of angle from 6° (lab.) up to 45° or higher. In the angular range above 20° the cross sections are determined to within ±0.3%. Below 20° the uncertainties become larger, approaching ±0.6% at 6°. Departures from pure S-wave scattering are observed at all energies. These deviations are larger than can be explained by the experimental uncertainties. They closely resemble the effect of a negative P-wave phase shift of approximately −0.1° at 4 Mev and exhibit a reasonable energy dependence. (auth)

1816

Radiation Lab., Univ. of Calif., Berkeley

STATISTICAL FLUCTUATIONS IN IONIZATION BY 31.5 MEV PROTONS, by G. J. Igo, D. D. Clark, and R. M. Eisberg. Nov. 24, 1952. [nd] 6p. (UCRL-2031)

Protons of 31.5-Mev energy were scattered elastically from a 0.00025-in. Pb target through a proportional counter and stopped in a NaI counter. The elastic protons were separated by a pulse-height analyzer fed from the NaI counter, the output being used to trigger the sweep of an oscilloscope. The proportional-counter pulses after amplification were applied to the vertical plates. The screen was photographed on moving film and the film read on a microfilm viewer. A histogram of the 1636 pulses read is given, and theoretical values of the average total energy loss and of maximum energy loss by a 31.5-Mev proton in a single collision with an electron are shown. The surprisingly broad distribution with high-energy tail is due to the high probability of collisions in which the charged particle imparts large kinetic energy to the electron, thereby greatly reducing the number of primary collisions. (L.M.T.)

1817

EXPERIMENTAL INVESTIGATION OF THE DIFFUSION OF SLOW ELECTRONS IN NITROGEN AND HYDROGEN. R. W. Crompton and D. J. Sutton. Proc. Roy. Soc. (London) A215, 467-80(1952) Dec. 22.

Results are presented of precise measurements of the diffusion of slow electrons in H_2 and N_2 in the presence of a uniform electric field. Such measurements lead directly to the value of Townsend's energy coefficient (k_T) as a function of Z/p (field strength/gas pressure). Since the drift velocity (W) of the electrons is also known, the following physical quantities are deduced as functions of Z/p: mean free path of the electrons at unit pressure, mean energy lost by an electron per collision, and collisional cross sections of the molecules. Measurements of the diffusion were obtained from two apparatuses which differed in dimensions and metal of the electrodes. The range of gas pressures employed was 3 to 14 mm Hg. A table shows that the values of k_T as a function of Z/p derived from these measurements agree (with one exception) to within 3%, and it is therefore considered that the measurements are trustworthy. The results are presented graphically and in tabular form. (auth)

1818

EVALUATION OF THE CROSS SECTION FOR COULOMB SCATTERING IN THE COLLISION OF TWO ELEMENTARY PARTICLES OF SPINS $n\hbar/2$ AND $m\hbar/2$ (m AND n INTEGRAL).

Gérard Petiau. Compt. rend. 235, 1612-14(1952) Dec. 22. (In French)

Expressions for the coulomb scattering cross sections are derived by a covariant calculation. (G.Y.)

1819

ELECTRON CAPTURE BY PROTONS PASSING THROUGH HYDROGEN. J. David Jackson and Harry Schiff. Phys. Rev. 89, 359-65(1953) Jan. 15.

A theoretical calculation is made of the capture of an electron by a particle of charge Z'e passing a hydrogen-like atom of charge Ze. Numerical results are presented for protons passing through hydrogen gas. In contrast to earlier treatments of this problem, the complete interaction hamiltonian is retained as the perturbation causing the electron transfer. Previous workers assumed that the interaction between the incident particle and the electron was the only perturbation causing the transition and ignored the interaction between the incident particle and the nucleus of the atom. Such a neglect is unjustified. The results of this paper show that when the complete interaction is used the agreement between theory and experiment is good for all energies greater than 25 kev ($\hbar v/e^2 \geq 1$) in the case of protons in hydrogen, even though the Born approximation is employed. This is a marked improvement over previous calculations which were approximately four to five times larger than experiment. (auth)

1820

THE $C^{12}(p,p)C^{12}$ DIFFERENTIAL CROSS SECTION. H. L. Jackson, A. I. Galonsky, F. J. Eppling, R. W. Hill, E. Goldberg, and J. R. Cameron. Phys. Rev. 89, 365-9(1953) Jan. 15.

The $C^{12}(p,p)C^{12}$ differential cross section has been observed at four scattering angles by using differentially pumped gas targets of propane and ethylene. The scattering angles employed were 106.4, 127.8, 148.9, and 169.2° (c.m.), and the energy range covered extended from 0.4 to 4.3 Mev. These measurements show the angular behavior of the previously discovered scattering anomalies at 0.46 and 1.7 Mev and give values of the absolute cross section accurate to within five %. A careful search in 3- and 6-kev steps failed to reveal any indication of any hitherto-unknown scattering resonances within the energy range surveyed. (auth)

1821

DISTRIBUTION IN ENERGY OF THE NEUTRONS FROM THE INTERACTION OF 14-MEV NEUTRONS WITH SOME ELEMENTS. Elizabeth R. Graves and Louis Rosen. Phys. Rev. 89, 343-8(1953) Jan. 15.

The neutron spectra from the interaction of 14-Mev neutrons with a number of elements have been determined by nuclear-plate techniques. The plates were exposed to neutrons from the bombardment of a Zr-T target by 200-kev deuterons when the target was as nearly as possible isolated from all scattering material and when the target was surrounded by a spherical shell of the element to be investigated. The variation of $F(E_n)$, the number of emitted neutrons per unit-energy interval with energy (E_n), appears to be Maxwellian in the region 0.5 to 4.0 Mev and may be represented by $F(E_n)dE_n = CE_n e^{-E_n/T} dE_n$. (auth)

1822

VARIATIONAL PRINCIPLES FOR THREE-BODY SCATTERING PROBLEMS. Sidney Borowitz and Bernard Friedman. Phys. Rev. 89, 441-5(1953) Jan. 15.

Several stationary expressions for the direct- and exchange-scattered amplitudes in three-body collisions are derived. (auth)

1823

INELASTIC EVENTS INDUCED BY 32-MEV PROTONS ON HELIUM. Jack Benveniste and Bruce Cork. Phys. Rev. 89, 422-9(1953) Jan. 15.

The thesis from which this material is taken was indexed as UCRL-1689 and abstracted in Nuclear Science Abstracts as NSA 6-3407.

1824

INTERFERENCE EFFECTS IN THE SMALL ANGLE SCATTERING OF X RAYS BY SMALL PARTICLES. G. E. Noakes and Elizabeth J. Allin. Can. J. Phys. 31, 40-8(1953) Jan.

Interparticle interference effects have been observed in the small-angle x-ray scattering from 30 samples prepared by the evaporation of gold colloids containing spherical particles of uniform size. The position of the interference maximum was found not to be the same for all samples containing particles of the same size. Calculation verifies that the position of this maximum is dependent on the radial distribution of the particles. It cannot be used for size determinations unless this distribution is known. The predicted variation of the slope at small angles of the ln I vs. k^2 curve with particle distribution was confirmed experimentally. This method of size determination is unsatisfactory whenever interference effects are present. It is suggested that size determinations based on the positions of the form-function maxima are almost independent of particle distribution even in concentrated samples. A unique determination of the particle distribution from the position and shape of the interference maximum would appear to be impossible even if the size were known. 20 references. (auth)

1825

SOME REACTIONS PRODUCED IN ILFORD EMULSIONS. W. K. Dawson and C. B. Bigham. Can. J. Phys. 31, 167-8 (1953) Jan.

A preliminary report is given on the reactions which have been identified upon irradiating Ilford C2 and E1 emulsions with a 70-Mev synchrotron beam. Using the method of energy unbalance, 310 $C^{12}(\gamma,3He^4)$ and 120 $O^{16}(\gamma,4He^4)$ stars have been identified. Over 50% of the stars observed have proton tracks, one group being of the form proton plus α particle plus recoil. Similiar reactions have two deuterons or a proton and triton substituted for the α particle, and in some cases a neutron and proton are substituted for a deuteron. (L.M.T.)

1826

THE RANGE-ENERGY RELATION FOR PROTONS AND ALPHA-PARTICLES IN DILUTED ILFORD G5 EMULSIONS. C. F. Lees, G. C. Morrison, and W. G. V. Rosser. Proc. Phys. Soc. (London) A66, 13-16(1953) Jan. 1.

An account is given of the experimental determination of the range-energy relations for protons and α particles in diluted Ilford G5 emulsions. The results are compared with those calculated by a method described by Webb. The range-energy relations for protons in the energy range 2.5 to 9 Mev can be represented by the empirical formulas $E = 0.227R^{0.562}$, $E = 0.221R^{0.565}$, and $E = 0.220R^{0.563}$ for Ilford G5, G5 × 2, and G5 × 4 emulsions, respectively, where E is in Mev and R in microns. (auth)

1827

INELASTIC NEUTRON SCATTERING IN IRON. B. Rose and J. M. Freeman. Proc. Phys. Soc. (London) A66, 120-1(1953) Jan. 1.

A method is described for measuring the excitation function of inelastic neutron scattering by studying the γ radiation from the excited states formed. The detector employed a naphthalene-anthracene crystal 1¾ in. in diameter and 1¼ in. thick with a photomultiplier. The Fe scatterer was an annular ring 2¼ in. I.D., 4½ in. O.D., and 1½ in. thick closely surrounding the crystal, and a polythene cone 6 in. long shielded the crystal from direct neutrons. For given neutron energies, spectra were taken first with the Fe scatterer in position, then with it removed, results showing about twice the counting rate with the ring in position. An excitation function for the γ rays following inelastic neutron scattering in

Fe was obtained from the difference curves taken at a number of neutron bombarding energies. (L.M.T.)

1828

THE ASYMPTOTIC SOLUTION OF AN EQUATION OCCURRING IN SCATTERING THEORY. G. A. Erskine and M. J. Seaton. Proc. Phys. Soc. (London) A66, 123-4(1953) Jan. 1.

This note provides a useful generalization of a well-known theorem in scattering theory, and particularly considers the case which arises when exchange distortion is allowed for in a scattering problem. (L.M.T.)

RADIATION EFFECTS

1829

North American Aviation, Inc.

BOMBARDMENT OF ORDERED Cu_3Au BY ONE MEV ELECTRONS, by C. E. Dixon, C. J. Meechan, and J. A. Brinkman. [nd] 2p. (AECU-2346)

An electron irradiation on Cu_3Au, made at approximately 60°C, consisted of about 10^{18} electrons/cm^2 of energy 1 Mev. The original resistivity of the specimen was 4.6 microhm-cm at 0°C and a 3% decrease was observed after several hours at 100°C, in agreement with Adam, Green and Dugdale (Phil. Mag., 43, 1216(1952)). A second irradiation was made at temperatures below −185°C to determine whether disordering could be produced by 1-Mev electrons. Before irradiation the specimen was held at 375°C for 40 hours, cooled slowly over a period of 400 hours to 200°, and held at this temperature for 300 hours. The resistivity was found to be 4.10 microhm-cm at 20°C and 1.52 microhm-cm at −195°C. It was subjected to a total flux of 3.4×10^{19} electrons/cm^2. Resistance measurements at −195°C after this bombardment showed no change in excess of the experimental error which was approximately 1%. The specimen was then allowed to anneal at room temperature for 350 hours. Intermittent measurements at −195°C showed a decrease of 2.7% in 50 hours. Between 50 and 350 hours the resistance showed both increases and decreases which exceeded the errors of the measurements. We have observed similar fluctuations during room temperature anneals of Cu_3Au which had been previously cold worked at −195°C, but have been unable to explain such behavior. After 350 hours at room temperature, a further anneal of 1 hour at 100°C showed no measurable resistance change. Calculations indicate that the fraction of atoms which should have been displaced by this irradiation is about 7×10^{-4}. According to Dexter (Phys. Rev. 87, 768 (1952)) such a density of interstitial-vacancy pairs should produce about a 5% change in the resistivity at −195°C. Because no such resistance change was observed, considerable recombination of the interstitial-vacancy pairs must have occurred at the temperature of irradiation. As a result of the low average energy of the displaced atoms, the average vacancy-interstitial separation distance may be so small that most of the pairs are unstable and can recombine without thermal activation. There appears to be a fundamental difference in the nature of the damage produced in metals by neutrons and by electrons since electrons do not produce disordering. We plan to measure the effect of electron irradiation on mechanical properties of metals and compare with the effects of neutron irradiation. (Entire report)

1830

Argonne National Lab.

THERMOLUMINESCENCE OF ICE, by Eugene C. Avery and Leonard I. Grossweiner. Dec. 10, 1952. 5p. (AECU-2367; UAC-678)

Samples of ice prepared from de-ionized water were irradiated with filtered 50-kv x rays at −183°C and slowly warmed in a detection apparatus using cooled photomultiplier tubes and pulse counting techniques. Thermoluminescence was observed and a typical glow curve was plotted. A principal peak at about −120°C and evidence of lesser peaks at higher and lower temperatures were observed. Some results are summarized. (J.E.D.)

1831

Hanford Works

THE EFFECT OF RADIOACTIVITY ON THE pH RESPONSE OF GLASS ELECTRODES, by W. N. Carson, Jr. and C. E. Michelson. Jan. 10, 1953. 12p. (HW-26763)

A variety of commercially available glass electrodes has been tested for the effect on pH response of high levels of radioactivity. No impairment of pH response was noted for prolonged exposures to solutions containing up to 200 c/gal of beta activity from mixed fission products and exposures to gamma radiation from mixed fission products up to 300,000 r/hr. All electrodes tested showed the same order of stability in the presence of radiation as is observed in its absence. (auth)

1832

RADIATION ABSORPTION AND ENERGY LOSS BY PRIMARY AND SECONDARY PARTICLES. F. W. Spiers. Discussions Faraday Soc., No. 12 13-24(1952).

The processes of absorption of ionizing radiation are reviewed, and their relative importance is discussed in terms of quantum energy. Examples of the energies of secondary electrons are given for commonly used radiations. The modes of energy loss by fast charged particles are described, and the magnitude of the energy required to produce one ion-pair is discussed in relation to particle type and speed and the properties of the absorbing medium. Some indication is given of the initial spatial distribution of the ionization. (auth)

RADIOACTIVITY

1833

North American Aviation, Inc.

AN INFLUENCE FUNCTION FOR THE BETA ACTIVITY OF URANIUM(235) FISSION PRODUCTS, by J. Kendall Thornton and William J. Houghton. Issued Sept. 1, 1950. Decl. with deletions Jan. 28, 1953. 30p. (AECD-3490; NAA-SR-45)

Computations have been made of the total β activity of the fission products arising from the slow-neutron fission of U^{235}. A curve is given exhibiting the activity per unit fission, for time intervals after fission ranging from 0.01 sec to 10 yr. This influence function is compared with some published experimental data and with the statistical curve of Way and Wigner. A curve of its integral as a function of the upper limit is also given. This latter curve facilitates estimation of the activity in the particular case where the fission rate has been constant throughout a known time interval. Finally, an influence function for the particular group of fission products consisting of complete and partial chains having volatile first members is given. (auth)

1834

Radiation Lab., Univ. of Calif., Berkeley

THE ALPHA BRANCHING OF AcK AND THE PRESENCE OF ASTATINE IN NATURE, by Earl K. Hyde and Albert Ghiorso. Nov. 19, 1952. 17p. (UCRL-2019)

Making use of the predictions of "alpha systematics" on the extent of α branching of the isotope AcK and of the properties of the resultant At^{219} daughter, the branching was looked for and found in the francium fraction isolated from a 20-mc source of Ac^{227}. The observed branching ratio is $\sim 4 \times 10^{-5}$, and the At^{219} daughter decays predominately by the emission of 6.27-Mev α particles with a half life of 0.9 min to the new isotope Bi^{215}, which in turn emits β^- particles with a half life of 8 min. At^{219} also decays by β^- emission to Rn^{219} about once in 30 disintegrations. It is pointed out that this is the first reported instance of a chemical identification of an isotope of element 85 from a

natural source, although other shorter-lived astatine isotopes are known to exist. 23 references. (auth)

1835

Radiation Lab., Univ. of Calif., Berkeley

STUDIES OF NEUTRON-DEFICIENT ISOTOPES OF EMANATION, FRANCIUM, AND RADIUM (thesis), by F. F. Momyer. Feb. 1953. 70p. (UCRL-2060)

A search was made for new isotopes of Rn, Fr, and Ra in the region of the 126-neutron closed shell. The investigations of Rn activities were greatly facilitated by the development of a method for preparing Rn samples which could be counted by techniques typical for active nongaseous samples. This technique consisted of ionizing Rn atoms in a glow discharge and accelerating them into a wire or Pt plate through a potential of several hundred volts. Activities assigned to Rn^{211}, Rn^{210}, Rn^{209}, Rn^{208}, and Rn^{221} were discovered, and their decay characteristics were studied. The plot of α decay energy vs. neutron number of Rn isotopes is strikingly similar to the plots for At and Po isotopes at and below 126 neutrons. Numerous experiments indicate that no low-mass Fr isotopes, other than Fr^{212}, exist with half lives of greater than 5 min. In bombardments of Pb with carbon ions in the 60-in. cyclotron at Crocker Laboratory in Berkeley, a new activity assigned to Ra^{213} was observed, and its half life and α-particle energy were determined. A sharp drop in α-particle energy due to the 126-neutron closed shell is indicated in Ra as in other elements down to Bi. (auth)

1836

COINCIDENCE INVESTIGATION OF THE γ SPECTRUM FROM $^{214}_{83}Bi$ (RaC). F. Demichelis and R. Malvano. Nuovo cimento (9) 9, 1106-8(1952) Nov.

Coincidence and angular-correlation studies of the Bi^{214} γ rays indicate that there is at least one γ-ray cascade, suggesting the existence of an intermediate state among the Po^{214} energy levels. (G.Y.)

1837

STUDIES ON RADIOACTIVE BROMINE. Eric Berne. Acta Polytech. Chem. Met. Ser. 3, No. 3(1952). 46p.

The half life of Br^{82} has been determined to be 36.0 ± 0.2 hr. The preparation of Br^{82} with high specific radioactivity from material irradiated in the Harwell pile is described. A Szilard-Chalmers reaction is used, and Br^{82} is separated using a new type of anion-exchanger. The retention and decomposition of $KBrO_3$ during irradiation in the pile have been investigated, and the results have been applied to a calculation of the maximum concentration factor, which is found to be 10^2. Using an improved irradiation technique it should be possible to increase the concentration factor to 10^3. The analytical determination of Br^{82} has been investigated. The back-scattering, absorption, and self-absorption of the radiation have been studied. It has been found possible to calculate self-absorption factors from measured values of the absorption in Al and values of the back-scattering factors. (auth)

1838

THE DISINTEGRATION OF RADIUM D. A. A. Jaffe and S. G. Cohen. Phys. Rev. 89, 454-8(1953) Jan. 15.

The disintegration of radium D has been investigated using a gaseous source of lead tetramethyl in a proportional counter. The form of the low-energy β spectrum coincident with the 46.7-kev γ ray has been determined. The end point has been found to be 15.2 ± 1 kev. The shape of the spectrum shows good agreement with the Fermi theory for an allowed transition, in which the effect of screening on the coulomb factor is neglected. The results indicate that the number of β particles below 3 kev is somewhat less than that predicted by theory, neglecting screening. It is also concluded that the change in binding energy of the atomic electrons (about 10 kev) released in the decay is included in the energy of disintegration of the β particles and is shared between the β particle and neutrino. 14 references. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

1839

Radiation Lab., Univ. of Calif., Berkeley

STUDIES OF NEUTRON DEFICIENT TERBIUM NUCLIDES, by M. A. Rollier and J. O. Rasmussen. Jan. 9, 1953. 8p. (UCRL-2079)

Bombardment of Eu oxide with α particles of energies from 38 to 75 Mev inclusive were made, and various studies on the Tb nuclides produced were carried out. No distinctive new activities were observed in Geiger-counter decay-curve resolution. A probable mass assignment of 151 for the 19-hr Tb α emitter was made on the basis of bombardment-energy threshold observations and a slightly lower half-life value of 17.2 hr determined. Attempts at mass-spectrographic mass assignment of this α emitter were unsuccessful. Lower limits on the α to electron capture branching ratios for Tb^{149} and Tb^{151} were determined experimentally. The Tb chemical fraction from a 38-Mev α bombardment of Eu oxide was examined in a high resolution β spectrometer. The results are given in summary form. (auth)

1840

THE THEORY OF THE MAGNETIC PROPERTIES OF RARE EARTH SALTS: CERIUM ETHYL SULPHATE. R. J. Elliott and K. W. H. Stevens. Proc. Roy. Soc. (London) A215, 437-53(1952) Dec. 22.

The theory of a Ce^{+3} ion in a crystal is considered as that of a free ion with a single 4f electron outside closed shells, and the effect of the surrounding lattice is included as a static crystalline electric field. The problem is solved when this field has C_{3h} symmetry. It is possible that this theory will be applicable to many cerium salts. It is here applied to the ethyl sulfate for which fairly extensive experimental data are available. It is found that in order to obtain agreement with experiment it is essential to consider small terms of C_{3v} symmetry, the presence of which is not incompatible with the crystal structure. It is then possible to determine values of the magnitudes of the crystal fields and to fit the magnetic resonance data accurately and the susceptibility data to within a small percentage. (auth)

SHIELDING

1841

Argonne National Lab.

ZINC BROMIDE SOLUTION FOR USE IN SHIELDING WINDOWS, by William B. Doe. Sept. 1952. 30p. (ANL-4879)

Chemical, radiation, and low-temperature stability, optical transmission as influenced by metallic ions and contamination by container materials, and corrosive effects of Zn bromide solutions were studied. It was observed that the solution is useful as a transparent shielding material because its transmission for light is superior to nonbrowning lime glass. It has freedom from optical inhomogeneities, shielding power for gamma radiation equal to nonbrowning glass or concrete, capability of withstanding nearly the same total dose of radiation as nonbrowning glass, and no observable deterioration. (J.E.D.)

SPECTROSCOPY

1842

Norman Bridge Lab. of Physics, Calif. Inst. of Tech.

NINETEENTH QUARTERLY REPORT [ON] FUNDAMENTAL RESEARCH IN SPECTROSCOPY OF SHORT WAVE-LENGTH X-RAYS AND GAMMA-RAYS [FOR] PERIOD–OCT. 1–DEC. 31, 1951, by Jesse W. M. DuMond. [nd] 22p. (NP-4251; Quarterly Report No. 19)

Progress is reported in the following studies: (1) recalibration of the 2-m curved-crystal focusing γ-ray spectrometer, (2) remeasurements of the Au^{198} half life and annihilation radiation wavelength, (3) axial-focusing magnetic β-ray spectrometer, (4) progress with point-focusing x-ray monochromator for low-angle x-ray diffraction, and (5) plans for construction of an improved curved-crystal γ-ray spectrometer. (L.M.T.)

1843

Mallinckrodt Chemical Lab., Harvard Univ.

A (K+2)ND ORDER FORMULA FOR ASYMMETRY DOUB DOUBLETS IN ROTATIONAL SPECTRA, by Daniel Kivelson. [nd] 10p. (NP-4268)

Higher-order perturbation theory is used to derive a formula for K-type doubling of the energy levels of a rigid asymmetric rotor. The result is

$$\Delta W = \Delta W_0[1 + \{A + BJ(J+1) + CJ^2(J+1)^2\}\beta^2]$$

where ΔW_0 is the Wang Kth order result for the splitting of the energy levels, β is the Wang asymmetry parameter, and A, B, and C are independent of the structural parameters and of the quantum number J. A, B, and C have been tabulated for all values of K up to K = 14; furthermore, simple formulas for the extension of these tables are given. (auth)

THEORETICAL PHYSICS

1844

Knolls Atomic Power Lab.

MEMBRANE AND BENDING ANALYSIS OF AXISYMMETRICALLY LOADED AXISYMMETRICAL SHELLS, by G. Horvay, and I. M. Clausen. [nd] 18p. (AECU-2343)

This paper, as well as subsequent ones, is intended to supplant older tables on shell design and is based on the more comprehensive theory of E. Reissner ("On the Theory of Thin Elastic Shells," Reissner Anniversary Volume, p.231, J. W. Edwards, 1949). Membrane formulas are given for general thin-walled shells, specialized to conical and spherical shells, and listed individually for weight, gas pressure, and liquid pressure loadings. Zeroth-approximation bending formulas for general shells are given. (L.T.W.)

1845

PROOF THAT PROBABILITY DENSITY APPROACHES $|\psi|^2$ IN CAUSAL INTERPRETATION OF THE QUANTUM THEORY. David Bohm. Phys. Rev. 89, 458-66(1953) Jan. 15.

In two previous papers a causal interpretation of the quantum theory was developed which involved the hypothesis that a quantum-mechanical system contains a precisely defined particle variable x but that, at present, we are restricted to calculating the probability density P(x,t) that the particle is at the position x. It was shown that the assumption that $P(x,t) = |\psi(x,t)|^2$ is consistent, in the sense that if it holds initially, the equations of motion of the particles will cause this relation to be maintained for all time. In this paper, the theory is extended by showing that as a result of random collisions, an arbitrary probability density will ultimately decay into one with a density of $|\psi(x,t)|^2$. Since all quantum-mechanical experiments to date have been concerned with statistical ensembles of systems that have been colliding with other systems for a very long time, it is therefore inevitable that as samples are drawn from such ensembles, the probability density of systems with particles at the point x will be equal to $|\psi(x,t)|^2$. In the previous papers it was also pointed out that, within the conceptual framework of the causal interpretation, it was possible to suggest mathematical theories more general than are permitted by the usual interpretation and that these more general theories might be needed in the domain of 10^{-13} cm, where present theories seem to fail. However, if these more general theories should apply at the level of 10^{-13} cm, then there would be a tendency to create discrepancies between P and $|\psi|^2$, a tendency whose cumulative effects should be felt even at the atomic level, where the more general theory ought to approach the usual theory. However, because those discrepancies have been shown to die out as a result of collisions, it can be expected that under normal conditions the difference between P and $|\psi|^2$ would be negligible. Conditions are suggested, however, in which this difference might be appreciable, and experiments are indicated which might be able to test for the existence of such discrepancies. (auth)

1846

NOTE ON THE CONCEPT OF VACUUM IN QUANTUM ELECTRODYNAMICS. F. A. Kaempffer. Can. J. Phys. 31, 165-6(1953) Jan.

This note gives further treatment to Dirac's postulate that in vacuum all states of negative energy are filled up with electrons and that these electrons do not produce an external field and do not give any contribution to the total energy and momentum of the system. Specifically, the rest energy and kinetic zero-point energy of the electrons and the energy of the system due to the electromagnetic interaction of the electrons are considered. (L.M.T.)

1847

THE CURRENT DENSITY IN QUANTUM ELECTRODYNAMICS. H. C. Corben. Nuovo cimento (9) 9, 1071-7(1952) Nov. (In English)

The formulation of field theory given previously suggests an alternative expression for the current density in quantum electrodynamics. This expression is gauge-invariant and conserved and differs from the usual current density by the divergence of a tensor which vanishes in the absence of a field. Corresponding to this current is a new electromagnetic field, which differs from the old only in the presence of particles. The energy density of this new field then contains the interaction energy of the magnetic moments of the particles with the magnetic field, together with some terms which are small for atomic electrons. (auth)

1848

SIMPLE MODEL OF TWO INTERACTING FIELDS. A. Loinger. Nuovo cimento (9) 9, 1080-6(1952) Nov. (In Italian)

In order to elucidate the meaning of the divergences which occur in the field theories, the author investigates, through the conventional quantization method of Heisenberg and Pauli, a model of interacting fields consisting of two strings elastically coupled point to point and transversally vibrating in the same plane. Particularly, the author ascertains that a remarkable "orthogonality theorem" which was proved by van Hove for a scalar boson field in scalar interaction with several sources, is not true for the present model. Conclusion is to be drawn that the aforesaid theorem is not exclusively dependent on the fact that a field is a system with an infinity of degrees of freedom. (auth)

1849

RELATION BETWEEN EVEN AND ODD COUPLINGS IN BETA-DECAY THEORY. S. Ferroni. Nuovo cimento (9) 9, 1103-5(1952) Nov. (In English)

The relations existing between even and odd couplings and, in particular, the problem of reducing a calculation based on a general odd interaction hamiltonian to one of standard type depending on a suitable even hamiltonian have been studied. The considerations are limited to β decay of nucleons and are strictly valid under the assumption that the neutrino mass is exactly zero. (G.Y.)

1850

GEOMETRICAL REPRESENTATION OF PARTICLES AND THE THREE-WAVE METHOD. F. Aeschlimann. J. phys. radium 13, 600-4(1952) Dec. (In French)

The first elements of a method intended to reconcile L. de Broglie's theory of the double solution with the usual quantum theories are presented, beginning with a critique of the idea of a physical system and the geometrical representation of particles. In the present theory, a particle is represented by a space-time point function u, which is compared with the wave function ψ of wave mechanics. Predictions for a particle described by the functional representation are expressed by means of a functional X(u,t). Three types of waves come into consideration: the physical wave u, the summary predictional wave ψ, and the functional predictional wave X, hence the name of the method, three-wave (triondulatoire). (tr-auth)

1851

PREDICTIONS AND THE THREE-WAVE METHOD. P. Destouches-Février. J. phys. radium 13, 605-9(1952) Dec. (In French)

The predictional calculus of the three-wave theory is established and compared with that of wave mechanics. The equation of evolution of a system of particles is given, with a transposition of integral formalism from quantum theory. Finally, the indiscernibility of particles of the same type is examined. (tr-auth)

1852

CONVERSION OF AN AMPLIFIED DIRAC EQUATION TO AN APPROXIMATELY RELATIVISTIC FORM. W. A. Barker and Z. V. Chraplyvy. Phys. Rev. 89, 446-51(1953) Jan. 15.

A fermion is described by a one-body relativistic wave equation of the Dirac type in which scalar, vector, tensor, pseudovector, and pseudoscalar interactions are included phenomenologically. This equation is converted to an approximately relativistic form by means of the Foldy-Wouthuysen transformation. The resulting relativistic correction terms associated with the five types of interaction are tabulated. The tables may be used to convert any one-body Dirac equation to its corresponding approximately relativistic form. The fine structure of the hydrogenic atom including the Lamb-Retherford shift is discussed as an illustration. 13 references. (auth)

1853

PRIMITIVE QUANTIZATION IN THE RELATIVISTIC TWO-BODY PROBLEM. J. L. Synge. Phys. Rev. 89, 467-73 (1953) Jan. 15.

A pair of events, one for each of two particles, is regarded as a point in 8 space (V_8). The technique of Hamilton's optical method is applied to V_8, giving rays and associated de Broglie waves. These waves are quantized by associating a phase cycle with an increase of h in the characteristic function, and hence quantum rules appear as resonance conditions on the de Broglie waves, when the part of V_8 occupied by rays is multiply connected. A hamiltonian equation is written down, the interaction between the particles being taken to be of coulomb form, but with ordinary distance replaced by Minkowskian separation. This leads without approximation to a simple expression for quantized proper energies of the system, and from this expression follow the correct approximate energy levels for the hydrogenic atom (with Z_α), the mass-correction factor being included. There is no approximation based on smallness of relative velocity or ratio of masses, and mathematical complexities associated with retarded potentials are avoided by the use of the relativistic coulomb interaction. (auth)

URANIUM AND URANIUM COMPOUNDS

1854

Oak Ridge National Lab.

THE ELECTRICAL CONDUCTIVITY OF URANYL SULFATE AND URANYL FLUORIDE IN AQUEOUS SOLUTION, by Robert D. Brown, W. B. Bunger, W. L. Marshall, and C. H. Secoy. [Dec. 1952]. Decl. Dec. 19, 1952. 30p. (AECD-3488; CF-52-12-56(rev.))

The conductance of uranyl sulfate in aqueous solution has been studied at 0, 25, 50, and 90°C in concentrations ranging from 10^{-4} to 7.25N; uranyl fluoride has been studied at 0, 25, 50, and 90°C in similar concentration. Both substances prove to be weak electrolytes. The equivalent conductance at infinite dilution of uranyl sulfate at several temperatures has been calculated assuming incomplete dissociation even in dilute solution. A value of $\Lambda_0 25° = 210$ ohms^{-1} cm^2 has been obtained when no correction is made for the conductivity of H^+ ion present from hydrolysis. Correction for H^+ ion leads to a value of 132 ohms^{-1} cm^2 for $\Lambda_0 25°$, which appears to give a more reasonable value for $\lambda_0\ UO_2^{++}$. The degree of dissociation of uranyl sulfate into simple ions has been calculated from conductivity data and a tentative value for the mean activity coefficient has been calculated. These values have been used to determine the dissociation constant for the process. Finally, the heat of dissociation, the free energy, and entropy of dissociation have been calculated. No evaluation of the data on uranyl fluoride has been made other than to show that the increase in equivalent conductance with temperature is due to the decrease in viscosity of the solvent. (auth)

1855

Tufts Coll.

QUARTERLY REPORT – PART A. THERMODYNAMIC ESTIMATION OF FEASIBILITY OF CERTAIN REACTIONS LEADING TO U OR UH_3; PART B. THERMODYNAMICS OF HYDRIDE DISSOCIATION, FOR PERIOD ENDING NOVEMBER 1, 1952, by Thomas R. P. Gibb, Jr. and Charles E. Messer. Issued Nov. 7, 1952. Decl. with deletions Feb. 3, 1953. 57p. (AECD-3492; NYO-3912)

This report describes preliminary investigations of the thermodynamic feasibility of preparing U or its hydride by reduction of common U compounds with selected alkali or alkaline-earth metals and their hydrides. Thermodynamic constants have been taken from the available literature or estimated by conventional procedures. These data are tabulated and the results of thermodynamic feasibility calculations based thereon are presented in graphical form. The second part of the report deals with a theoretical treatment of metal-hydrogen systems and represents the first stage in the development of an equation of state. It is hoped that further extension of this approach will result in an equation which will permit calculation of the equilibrium pressure of H over a solid phase of any known H content at any temperature. The general theoretical treatment given is applied to experimental data on the Pd-H, Zr-H and U-H systems. There seems to be no reason why it should not be equally applicable, with minor modifications, to the Na-H and Ca-H systems, etc. (auth)

1856

Knolls Atomic Power Lab.

THE REFINED CRYSTAL STRUCTURE OF BETA-URANIUM, by C. W. Tucker, Jr. and P. Senio. Nov. 3, 1952. 36p. (KAPL-844)

The refined crystal structure of β uranium reveals that the main layers of the structure are flat whereas the subsidiary layers are rumpled. This places the crystal in the space group P 4/mnm rather than P 4nm as previously reported. However, the rumpling of the subsidiary layers is a definite departure from the perfect layering suggested by Shoemaker and Bergman. Calculation of the interatomic distances in β uranium reveals an unusually short uranium-uranium distance of 2.592 A. This compares with 2.762 A, the shortest interatomic distance in either the α or γ phases of the metal, and 2.69 A, the shortest in any of the interme-

tallic compounds of uranium for which the complete structure is known. However, comparison with the bond distances in the α neptunium structure recently given by Zachariasen shows that the short β uranium distance is comparable with the short α neptunium distances. Therefore, the interatomic distance of 2.592 A for β uranium does not appear unreasonable, but is nevertheless unusually short. Consideration of the electronic structure of the heavy elements indicates that there are variations in the relative numbers of 5f and 6d electrons from one phase to another in the heavy metals and from the solid to gaseous atoms. It appears that the 5f orbitals are involved in the metallic bonding and that this may account for the fact pointed out by Zachariasen that so many of the heavy metal crystal structures are unique. The β uranium structure is compared in detail, as far as possible, with refined σ-phase structures. It is found that although the structures have the same space group, there are real differences in atomic positions, particularly of atoms in the subsidiary layers. The contention of Thewlis that there are intensity differences between β-phase powder patterns from the pure metal and from low-chromium alloys at 720°C is considered in detail. The major intensity discrepancy reported by Thewlis for the powder pattern of the low-chromium alloy is not found in the single crystal data from an alloy of identical composition. After consideration of this and other factors it is concluded that the β-phase structures for the low-chromium alloys and the pure metal are identical. (auth)

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses.

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers.

For a list of the abbreviations used in this section, see NSA, Vol. 7, No. 1, page "SUPPLEMENT 1".

$^{95}_{41}Nb_{54}$ $^{90^h}$

γ (0.22) K/LM = 2.5 s1 ce$^-$

V.S.Shpinel, Zhur. Eksptl' i Teoret. Fiz. 22, 255(1952); Phys. Abst. 55-8254(1952).

Mo Neutron resonances (ev) E_n = 1 ev to 10 kev

46.3 $\sigma_o\Gamma^2$ = 400

75

140

~440

E.R.Hodgson, J.F.Gallagher, E.W.Bowey, Proc. Phys. Soc. 65A, 992(1952).

$^{100}_{42}Mo_{58}$

$\tau_{\beta\beta}$ $>10^{15}$y ppl

Assuming decay energy $\geq$2 Mev

Definite evidence of activity

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Rh Neutron resonance (ev) cryst s

1.260

H.H.Landon, V.L.Sailor, M.L.Foote, Jr., BAPS 28, 1, M8(1953).

Ag Neutron resonance (ev) cryst s

5.24

H.H.Landon, V.L.Sailor, M.L.Foote, Jr., BAPS 28, 1, M8(1953).

Neutron resonances (ev) E_n = 15 to 100 ev

16.5 40 52 71

30.7 43 56 88

J.S.Levin, W.Y.Kato, N.G.Sjostrand, D.J.Hughes, BAPS 28, 1, M10(1953); verbal report.

$^{104}_{47}Ag_{57}$

τ 27^m d ^{59}Cd

β^+ 2.70 sπ

γ 0.555

Number of weaker γ's tentatively assigned

F.A.Johnson, Proc. Roy. Soc. Canada 46, 135A (1952).

$^{104}_{48}Cd_{56}$

τ 59^m Ag(50-Mev p) chem

β^+ 0.93 sπ

γ 0.0666

0.0835

W 0.1498

F.A.Johnson, Proc. Roy. Soc. Canada 46, 135A (1952).

$^{105}_{48}Cd_{57}$

τ 55^m Ag(55-Mev p) chem

β^+ 1.68 sπ

γ 0.0254 (K x ray?)

2.1

F.A.Johnson, Proc. Roy. Soc. Canada, 46, 135A (1952).

$^{114}_{48}Cd_{66}$

Capture γ's Cd(n,γ) pair s

0.38†	6.82	0.12†	7.84
0.21†	7.67	0.23†	8.48
0.16†	7.73	0.14†	9.05

†Photons per 100 n captures

G.A.Bartholomew, E.B.Kinsey, BAPS 28,1, J6(1953).

Capture γ's Cd(n,γ) s1 pe$^-$

89†	0.555	11$^{\dagger *}$	0.80
25$^{\dagger *}$	0.646	20$^{\dagger *}$	1.30

†Photons per 100 n captures

H.T.Motz, BAPS 28, 1, J8(1953); *verbal report.

$^{116}_{48}Cd_{68}$

$\tau_{\beta\beta}$ $>8\times10^{15}$y ppl

Assuming decay energy $\geq$2 Mev

J.H.Fremlin, M.C.Walters, Proc Phys. Soc. 65A, 911(1952).

$^{124}_{50}Sn_{74}$

$\tau_{\beta\beta}$ $>2\times10^{15}$y ppl

Assuming decay energy $\geq$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$Sb^{124}_{51\ 73}$ 60^d

γ	154^+	0.60	17^+	1.35	$s\pi$ Cpt
	19^+	0.71	100^+	1.69	
	6.6^+	0.96	10^+	2.07	
	4.4^+	1.05			

K.Gromov et al., Doklady Akad. Nauk SSSR 86, 255(1952).

$(2.27\beta^-)(0.60\gamma)$ polarization-direction
0.06γ no parity change

D.R.Hamilton, A.Lemonick, F.M.Pipkin, BAPS 28, 1, S4(1953).

(0.60γ) (2.27β) Sb(pile n); scin
(0.60γ) (1.70γ) (0.60γ) (2.08γ) ?
(0.60γ) $(0.65\gamma$ and/or $0.73\gamma)$

S.A.E.Johansson, S.Almquist, Arkiv Fysik 5, 427 (1952); Nature 170, 583(1952).

$Te^{130}_{52\ 78}$ $\tau_{\beta\beta}$ $> 4 \times 10^{15}$ y ppl
Assuming decay energy ≥ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$Xe^{121}_{54\ 67}$ τ 70 m I(80-Mev p) chem

D.E.Tilley, Proc. Roy. Soc. Canada 46, 135A(1952).

$Xe^{122}_{54\ 68}$ τ 19.5 h p 3.6 m I I(80-Mev p) chem

D.E.Tilley, Proc. Roy. Soc. Canada 46, 135A(1952).

$Xe^{123}_{54\ 69}$ τ 2.1 h I(80-Mev p) chem

D.E.Tilley, Proc. Roy. Soc. Canada 46, 135A(1952).

$Cs^{134}_{55\ 79}$ 2.3 y

β^-	22%	0.085*			Cs(slow n); s
	6%	0.28*			
	9%	0.42*			
	65%	0.65*			
γ	137^+	(~0.58)	3^+	1.15	s pe^-
	100^+	0.788	3^+	1.35	
	$\sim 2^+$	~1.0			

K.Gromov, B.Dzhelepov, Doklady Akad. Nauk SSSR 85, 299(1952). *N.Antonʹeva et al., Ibid.

$\gamma\gamma(\theta)$ polarization observed scin

B.L.Robinson, L.Madansky, Phys. Rev. 88, 1065 (1952).

$Cs^{135}_{55\ 80}$ β^- 0.210* $\Delta I = 2$, no shape s

L.Lidofsky, E.Alperovitch, C.S.Wu, BAPS 28, 1, Z2(1953); *verbal report.

$Cs^{137}_{55\ 82}$ γ 0.6617 $s\pi/2$ ce^- pe^-

G.Lindström, K.Siegbahn, A.H.Wapstra, Proc. Phys. Soc. 66B, 54(1953).

$Ba^{138}_{56\ 82}$ $\tau_{\beta\beta}$ $> 10^{15}$ y ppl
Assuming decay energy ≥ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$Ce^{143}_{58\ 85}$

β^-	100^+	0.71	Ce^{142}(pile n,γ),
	133^+	1.090	U(pile n,f) chem
	100^+	1.390	
γ	$\sim 20^+$	0.126	sl pe^-, scin
		~0.160	
	100^+	0.290	
	$\sim 20^+$	0.356	
	$\sim 25^+$	0.660	
		0.72	

Unresolved lower energy β
(0.126γ) (0.160γ)

W.H.Burgus, Phys. Rev. 88, 1129(1952).

Ho Neutron resonances (ev) E_n = 0.1 to 30 ev
3.96 cryst s
12.8

M.L.Foote, Jr., V.L.Sailor, H.M.Landon, BAPS 28, 1, M7(1953).

Er Neutron resonances (ev) E_n = 0.1 to 30 ev
0.51 9.55 21.2 cryst s
6.10 16.0 27.5

M.L.Foote, Jr., V.L.Sailor, H.M.Landon, BAPS 28, 1, M7(1953).

Tm Neutron resonances (ev) E_n = 0.1 to 30 ev
3.96 cryst s
15.0
18.0

M.L.Foote, Jr., V.L.Sailor, H.M.Landon, BAPS 28, 1, M7(1953).

Lu Neutron resonances (ev) E_n = 0.1 to 30 ev
1.57 5.3 14.4 cryst s
2.62 11.4 24.0
4.80

M.L.Foote, Jr., V.L.Sailor, H.M.Landon, BAPS 28, 1, M7(1953).

$Lu^{176}_{71\ 105}$ Neutron resonance (ev) cryst s
0.142

M.L.Foote, Jr., V.L.Sailor, H.M.Landon, BAPS 28, 1, M7(1953); verbal report.

$Ta^{181}_{73\ 108}$

μ	1.9	S
Q	+5.9	

B.M.Brown, D.M.Tamboulian, Phys. Rev. 88, 1158 (1952).

$W^{186}_{74\ 112}$ $\tau_{\beta\beta}$ $> 6 \times 10^{15}$ y ppl
Assuming decay energy ≥ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$_{74}W^{187}_{113}$

γ 0.072 $\alpha_K \sim 2^*$ $\alpha < 2.5^*$ E1 pc
0.134 $\alpha_K \sim 2^*$ M1
0.686 E1
(0.48γ)(0.13γ) (0.55γ)(0.13γ) (0.78γ)(0.13γ)
No (0.61γ)(γ)
No 0.206γ (<3% of 0.134γ)
0.48γ precedes 0.072γ

A.W.Sunyar, BAPS 28, 1, Z3(1953); *verbal report.

Re Neutron resonance (ev) cryst s
2.16

H.M.Landon, V.L.Sailor, M.L.Foote, Jr., BAPS 28, 1, M8(1953).

$_{76}Os^{191}_{115}$ 14^h

γ (0.074) E3(73%) M4(27%)
From ratio K x rays 0.074γ/0.13γ <10

R.D.Hill, J.W.Mihelich, Phys. Rev. 89, 323(1953).

$_{76}Os^{192}_{116}$

$\tau_{\beta\beta}$ $>10^{14}$y ppl
Assuming decay energy $\geq$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Ir Neutron resonance (ev) cryst s
0.654

H.M.Landon, V.L.Sailor, M.L.Foote, Jr., BAPS 28, 1, M8(1953).

$_{77}Ir^{192}_{115}$ 70^d

γ 2^+ 0.200 100^+ 0.467 sl pe$^-$
3^+ 0.205 5^+ 0.486
50^+ 0.295 10^+ 0.589
50^+ 0.307 30^+ 0.606
100^+ 0.315

J.L.Wolfson, Proc. Roy Soc. Canada 44, 193A (1950).

$_{78}Pt^{198}_{120}$

$\tau_{\beta\beta}$ $>10^{15}$y ppl
Assuming decay energy $\geq$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Au Neutron resonance (ev) cryst s
4.93

H.M.Landon, V.L.Sailor, M.L.Foote, Jr., BAPS 28, 1, M8(1953).

$_{79}Au^{195}_{116}$ 30^s

τ 30^s d 9.5^{h}Hg chem
γ 0.056 sl ce$^-$
0.259

O.Huber, R.Joly, P.Scherrer, N.F.Verster, Helv. Phys. Acta 25, 621(1952).

$_{79}Au^{198}_{119}$

β^- 0.958 sl
1.370 $\Delta I = 3$, yes shape

J.L.Wolfson, L.G.Elliott, Proc. Roy. Soc. Canada 46, 142A(1952).

Hg Neutron resonances (ev) E_n = 3 ev to 10 kev

E_o	$\sigma_o\Gamma^2$
23.3	9
35.4	170
191	
~350	

E.R.Hodgson, J.F.Gallagher, E.M.Bowey, Proc. Phys. Soc. 65A, 992(1952).

$_{80}Hg^{195}_{115}$ 38^h

γ 0.036 Au(25-Mev d) chem
γ I.T. 0.122 sl ce$^-$

O.Huber, R.Joly, P.Scherrer, N.F.Verster, Helv. Phys. Acta 25, 621(1952).

9.5^h

τ_2 9.5^h Au(25-Mev d) chem
γ 0.061 sl ce$^-$
ce$^-$ 0.099

O.Huber, R.Joly, N.F.Verster, Helv. Phys. Acta 25, 621(1952).

$_{81}Tl^{204}_{123}$

β^- 98.5% 0.760 $\Delta I = 2$, yes shape 4π scin
ϵ ~1.5%

$E_{dis}(\epsilon) \sim 0.4$ (calc)
No 0.37γ ($<10^{-2}$%)

E.der Mateosian, A.Smith, Phys. Rev. 88, 1186 (1952).

$_{82}Pb^{210}_{128}$

γ $\sim 10^+$ 0.0464 $\alpha = 8.5$ pc sπ
L_I : L_{II} : L_{III} : M : NO
100 : 7.5 : 0.7 : 26 : 7.7
No other γ (<0.5%)
+Photons per 100 disintegrations

C.S.Wu, F.Boehm, E.Nagel, BAPS 28, 1, Z4(1953); verbal report.

$_{82}Pb^{212}_{130}$

τ 10.67^h

H.Buttar, Naturwiss. 39, 575(1952).

$_{83}Bi^{209}_{126}$

Very few low energy α's seen in Bi loaded plate; $\tau = 2 \times 10^{17}$y, E_α = 3 not confirmed

E.P.Hincks, C.H.Millar, Proc. Roy. Soc. Canada 46, 143A(1952).

$_{83}Bi^{210}_{127}$ 4.9^d

No ce$^-$, no nuclear γ pc sπ

C.S.Wu, F.Boehm, E.Nagel, BAPS 28, 1, Z4(1953).

$_{83}Bi^{212}_{129}$

(6.04α)(0.04γ)(θ) b=1.30 I= 1,3,4 or 1,4,5

J.Horton, R.Sherr, BAPS 28, 1, Z5(1953).

$_{88}Ra^{226}_{138}$

γ (0.186) $\alpha = 0.9^*$ E2 $\alpha\gamma$ coin
*Based on 4.61α = 6.4%

C.Victor, J.Teillac, P.Falk-Vairant, G.Boussieres, J. phys. radium 13, 565(1952).

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Th — Neutron resonances (ev) E_n = 2 ev to 2 kev

25	$\sigma_o\Gamma^2 = 64$
80	
170	

E.R.Hodgson, J.F.Gallagher, E.M.Bowey, Proc. Phys. Soc. 65A, 992(1952).

$Th^{228}_{90\ 138}$ γ (0.084) $\alpha = 12^*$ E2 $\alpha\gamma$ coin

*Based on $\gamma/\alpha = 0.02^{**}$

C.Victor, J.Teillac, P.Falk-Vairant, G.Boussieres, J. phys. radium 13, 565(1952); **M.Riou, ibid.

$Th^{230}_{90\ 140}$

γ	100^+	0.068	scin
	14^+	0.142	
	5^+	0.255	
	25^+	0.615	

+Photons per 10^4 disintegrations

F.Rasetti, E.C.Booth, BAPS 28, 1, Z6(1953); verbal report.

$Pu^{239}_{94\ 145}$

γ	40^+	0.039	pc
	140^+	0.053	sl ce$^-$, pc
	110^+	0.100	scin
	50^+	0.124	scin
	30^+	0.384	scin

M.S.Freedman, F.Wagner, Jr., D.W.Engelkemeir, Phys. Rev. 88, 1155(1952).

$Pu^{240}_{94\ 146}$ γ 0.050 Pu^{239}(pile n); sl ce$^-$

M.S.Freedman, F.Wagner, Jr., D.W.Engelkemeir, Phys. Rev. 88, 1155(1952).

$Pu^{241}_{94\ 147}$

β^-		0.0205	Pu^{240}(pile n); sl
γ	100^+	0.100 (K x ray?)	scin
	20^+	0.145	

+Photons per 10^7 β's

M.S.Freedman, F.Wagner, Jr., D.W.Engelkemeir, Phys. Rev. 88, 1155(1952).

$Am^{241}_{95\ 146}$

γ	25^+	0.0284	Pu^{240}(pile n,$\gamma\beta^-$); pc
		0.041	sl ce$^-$
	100^+	0.059	sl ce$^-$, pc

M.S.Freedman, F.Wagner, Jr., D.W.Engelkemeir, Phys. Rev. 88, 1155(1952).

Neutron Cross Sections

Reaction	σ Type	Value	Energy	Ref.
Mo(n)	σ_t	graph	1ev - 10kev	52h5
Hg(n)	σ_t	graph	3ev - 10kev	52h5
Th(n)	σ_t	graph	2ev - 2kev	52h5
	σ_t	6.11	13.9	5011

5011 A.H.Lasday, AECD-3018, NSA 5-869(1951).

52h5 E.R.Hodgson, J.F.Gallagher, E.M.Bowey, Proc. Phys. Soc. 65A, 992(1952).